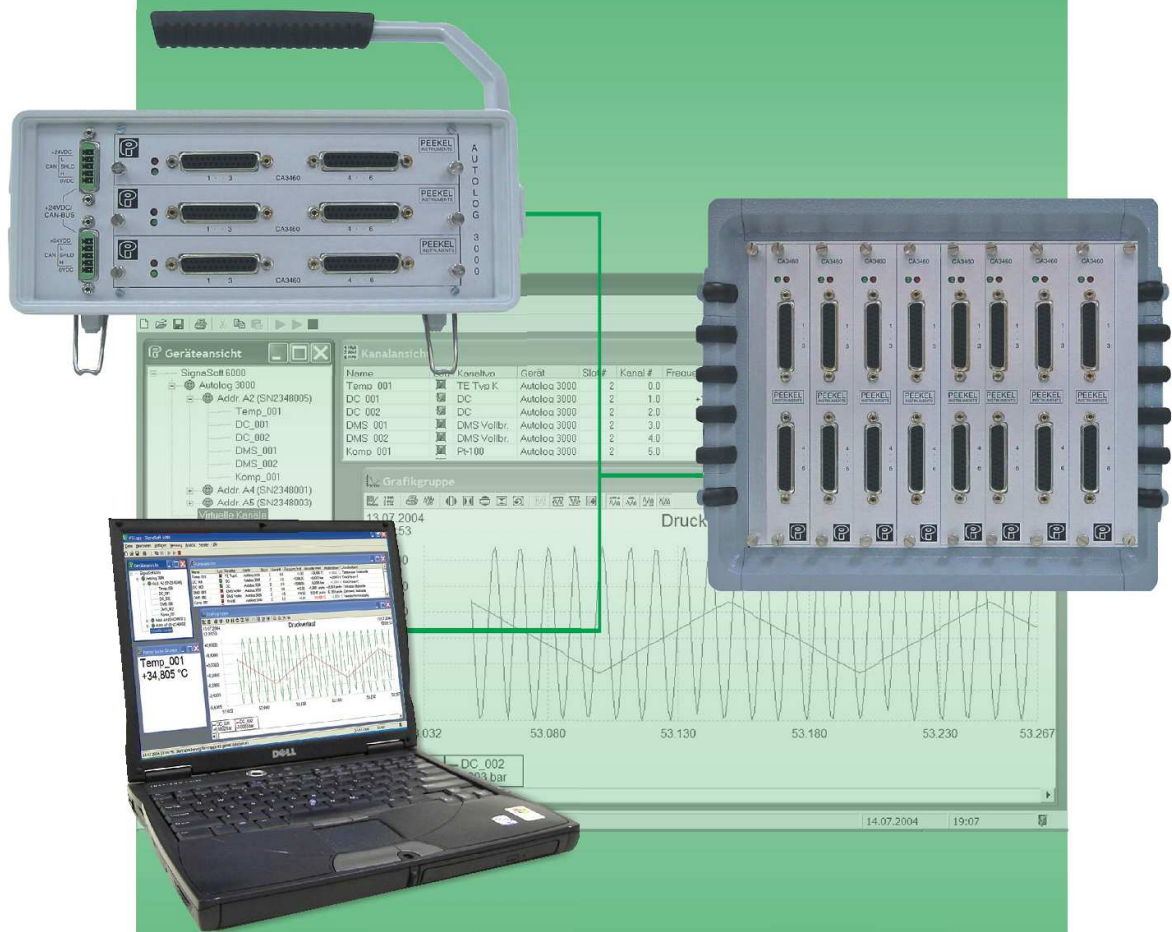


USER MANUAL

AUTOLOG 3000



PEEKEL
INSTRUMENTS



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1 Introduction

The Autolog 3000 concept is based upon the use of fully autonomously functioning measuring cards. These cards will condition the inputs, convert them to digital values, scale those values and buffer the measured values until they are transmitted to the controlling system.

The use of these universal modules makes it possible to configure “systems” from 6-channel boxes up till multiple 19" racks with 96 channels each. In this way, larger and de-centralized systems can be easily set up.

With this Autolog 3000 concept, Peekel Instruments offers its more than half a century worth of experience to today's high-accuracy computerized electronic measuring technology.

1.1 Housings

Depending on the number of cards needed, one of the following housings can be chosen:

- AUTOLOG 3000-1: table top housing in which 1 card can be mounted
- AUTOLOG 3000-3: table top housing in which 3 cards can be mounted
- AUTOLOG 3000-8: table top housing in which 8 cards can be mounted
- AUTOLOG 3000-16: 19" rack housing in which 16 cards can be mounted

1.2 Autolog 3000-3 housing

This table top housing can hold up to 3 cards. The input connectors of the cards are located at the front side of the housing. On the left side of the cards, the combined CAN-bus/power connectors are mounted. The 3 pins in the middle are the CAN lines and cable screen.

On pin 1 and 5 the power supply can be connected.

The Autolog 3000-3 can be used with an (optional) internal or an external power supply. The standard delivered external power supply is a little tabletop housing. The 24VDC power connector can be plugged directly into the Autolog 3000-3 housing.

Beware: this small external 24V power supply can supply power to max. 3 cards!

When the AUTOLOG 3000-3 is used with an internal power supply, a different panel is mounted on the rear side of the housing

Although the 24VDC is generated inside the AUTOLOG3000-3, **this supply is not available at the front side connectors**. It is not possible to use the internal power supply as power source for other CAN bus devices or sensors.

It is possible to use an external; power supply (9-36VDC) as the power source for this system. To use this power supply the internal power supply must not be connected to the mains



At the rear panel a special “SYNC” connector is present. On this connector a sync signal is present with a frequency of 1 kHz. This is a RS485 level signal:

pin	signal
1	Sync-h
2	Sync-l

This sync signal is used to synchronize all the channels which are converted at a speed of 1 kHz. All these signals will be converted at exactly the same moment on the positive edge of the sync signal.



1.3 Autolog 3000-8 housing

This table top housing can hold 1 to 8 cards. Input connectors of the cards are located at the front side of the housing.



At the rear side the combined CAN-bus/power connectors and “SYNC” connector are present.

To use this external power supply the internal power supply must not be connected to the mains.



1.4 Autolog 3000-16 housing

This 19” rack mounting housing can hold up to 16 cards. Input connectors of the cards are located at the front side of the housing.

At the rear side the combined CAN-bus/power connectors and “SYNC” connector are present.

To use this external power supply the internal power supply must not be connected to the mains.

1.5 Connecting Autolog 3000 to a PC

To configure the AUTOLOG 3000, as well as to store measured data, it must be connected to a PC. Depending on the type of Autolog 3000 housing, this connection can be made through CAN-bus, USB (option) or Ethernet (option ETH).

The CAN-bus has the advantage that multiple cards and/or housings can be connected in a decentralized way to a single bus. It is important to note that the CAN-bus speed is limited to 1 MBit/s, which equals about 7000 measurement values per second (for details: see specification of the CAN-bus cable).

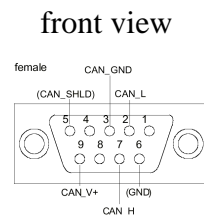
Because the CAN-bus cannot be connected directly to a standard PC, an external converter is used. By default a CAN/USB converter is used, but there are other options available like converters for CAN/Ethernet or CAN/WLAN (more information on request). Every converter has a 9-pins D-Sub connector for connecting the CAN-cable.


1.5.1 CAN communication cable

A cable is always delivered to connect the CAN/USB interface to the AUTOLOG 3000. The standard cable length is 2 meter.



5-----1



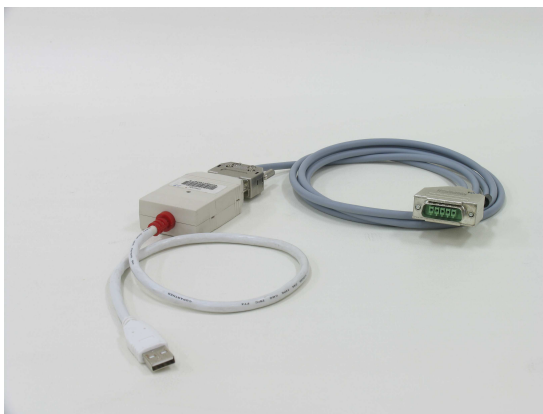
Autolog 3000		Signal description	Sub D9 female
1	-	0V	(yellow) 3
2	CL	CAN L	(white) 2
3		screen	Connector house
4	CH	CAN H	(brown) 7
5	+	+9-36V	

In the SubD9 connector a 120 ohm resistor is mounted over the CAN L and CAN H line. With this resistor the CAN bus is terminated at this end.

The connector used for the connection to the Autolog 3000 is made by Phoenix, type PSC 1.5/5-F. The cable housing is SCT-D-SUB 15-KG of Phoenix

On the other end of the cable a SubD9 connector is mounted. This connector must be connected to the CAN/USB converter.

It should **not** be connected directly to the comm. port of a PC!!




1.5.2 Autolog 3000 external power supply cable:

The Autolog 3000 can be used with an internal (option) or an external power supply. The standard external power supply is a tabletop housing. The 24VDC power connector can be plugged directly into the Autolog 3000-3 housing.



5----1

Autolog 3000		description	MPE-C036-24
1	Power supply	0V	screen
2	CL	CAN L	
3		screen	
4	CH	CAN H	
5	Power supply	+9-36V	core

Note: the MPE-C036-24 is the standard delivered external power supply with an Autolog3000-3. This power supply has a small coax cable connected to it.

1.5.3 Autolog 3000 Interlink cable:

When more Autolog 3000 systems are used, the same CAN bus can be used to connect those systems to 1 PC. Remember that the maximum throughput of the CAN bus depends on the CAN bus speed and is 7000 values/second at a data rate of 1Mbit/second.

When the Interlink cable is used to connect 2 Autolog 3000 systems, 1 CAN bus connector on each Autolog 3000 systems is used for this connection. Only 1 CAN bus connector is now available for the connection to the CAN-USB interface and to connect the power to the Autolog3000 system. In this situation the standard cables cannot be used. These 2 standard cables must now be reworked in such a way that both cables (CAN bus and power) are connected to 1 CAN bus connector.

Beware of the following points when connecting Autolog 3000 systems in such a way:

- The external power supply should be able to supply about 12W per card. **The MPE-CO36-24 will supply power for max. 3 cards!**
- In some cases it may not be possible to use the supplied cables, for instance when CAN-signal and power supply are separate. It may be necessary to combine those on a single connector.
- The maximum data rate on a CAN-bus depends on the total length of the bus-cable. For more details, see the specifications of this cable in chapter 8.

1.6 USB option

The Autolog 3000 system can be ordered with an USB option. An extra USB interface is build in the housing. An extra USB type B connector is available on the outside of the housing. A direct connection to a PC can be made through this USB connector.



Autolog 3000-3 with USB option



Autolog 3000-8 with USB option

The USB V1.1 is used with a data rate of 12Mbps.

Through this USB interface a maximum of 48000 measured values per second can be sent to the PC.

The USB interface can not be used simultaneously with the CAN bus. When the system is connected to the PC through the USB bus, no communication with the CAN bus is allowed. The CAN bus may be used after power-on with no connection of the USB connector.

1.6.1 USB interface and thermocouple measurement

Special care must be taken when thermocouples are measured with the use of the USB interface.

For a thermocouple measurement cold junction compensation must be used. The compensation is done through the measurement of the temperature of the place where the thermocouple wires are connected to normal wiring or connection terminals. This CJC measurement is done with the use of a PT100 element, which must be connected to an input of the Autolog 3000 system. To make it possible that this CJC temperature can also be used as a CJC for thermocouples measured on other input cards in the same Autolog 3000 system, those other cards will receive this CJC temperature through the CAN bus. The maximum transfer rate of the CJC temperature will be 5 Hz. To use the CAN bus a termination resistor of 120 ohm must be present at power-on.

The CJC will not function when this termination resistor on the CAN is not present!!!

1.6.2 Multiple Systems on 1 PC

More Autolog 3000 systems can be connected to 1 PC through different USB ports.

Remember that multiple USB ports on a PC are connected through an internal HUB and will have a total data rate of 12 Mbps (up to 48000 measurement values/sec for a single device, up to 60000 values for multiple devices).

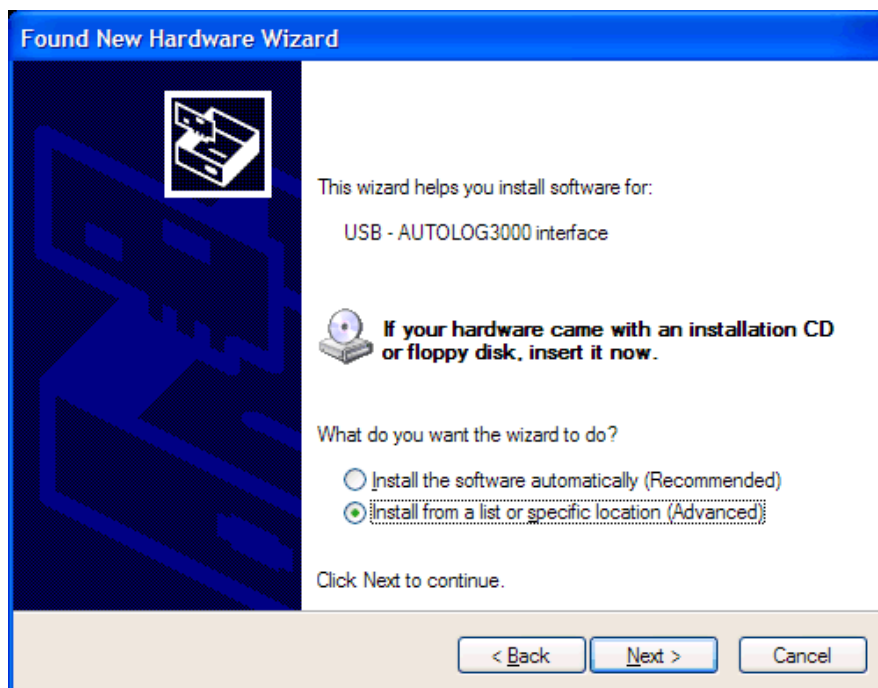
The maximum throughput for multiple Autolog 3000 systems connected to different USB-busses (not going through a single internal or external hub) depends on several PC-dependent factors and should be tested for each specific case.

1.6.3 USB Driver Installation (Windows XP)

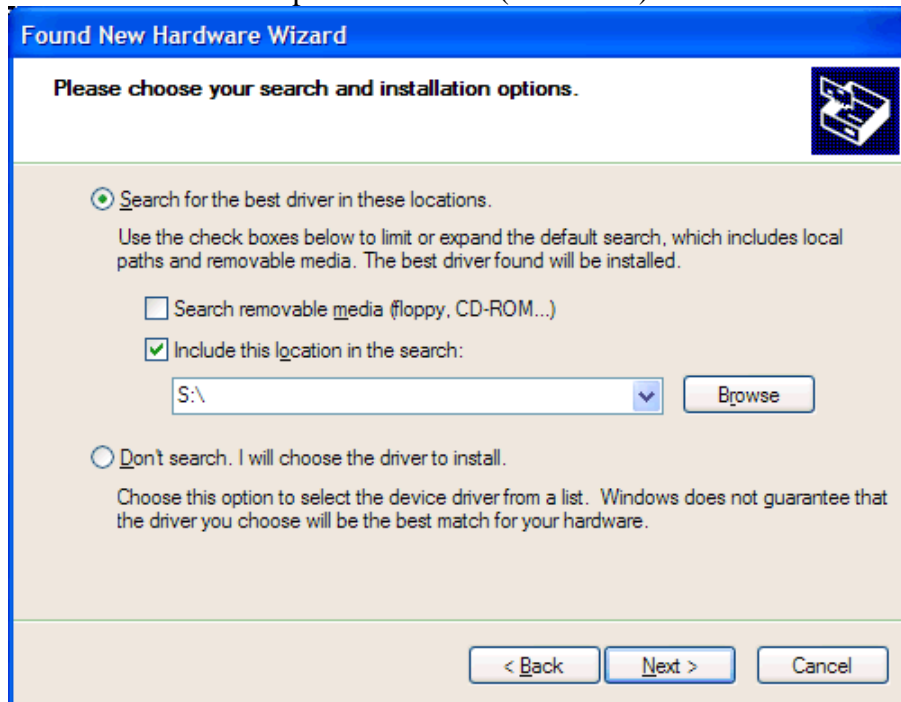
Start the PC, connect the Autolog 3000 to the PC using a USB cable and switch on the Autolog 3000. Windows will automatically detect a new device named 'USB – Autolog 3000' and show the following dialog:



Select the 'No, not this time' option and click 'Next' to continue.



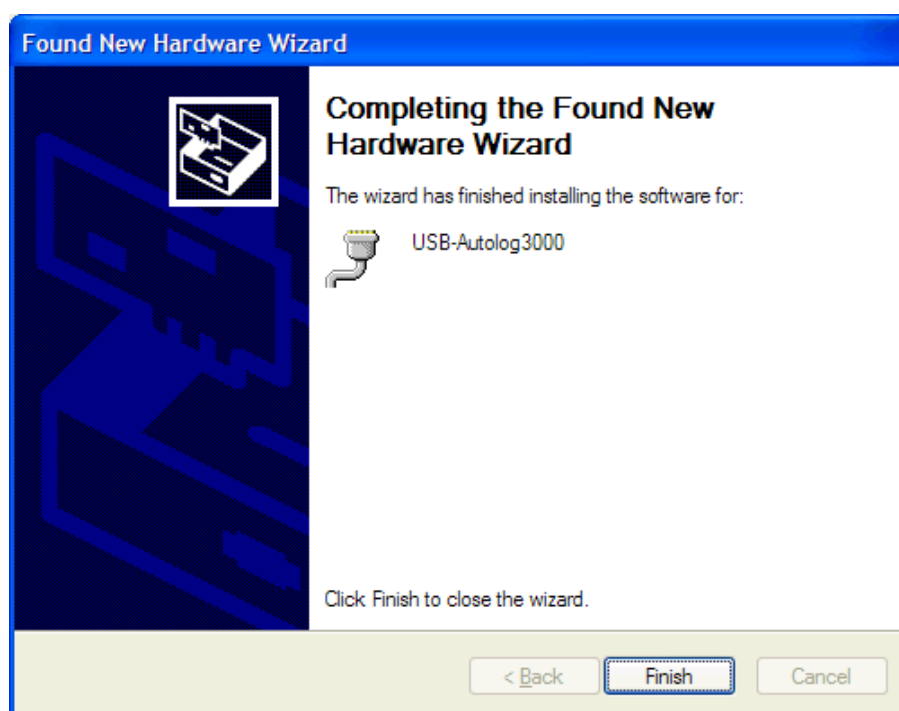
Now select 'Install from a list of specific location (Advanced)' and click 'Next'.



Choose 'Search for the best driver...' and check the 'Include this location in the search' box. Then browse for the location of the driver, which can be found in the root directory of the installation CD. Click 'Next' to continue.



Windows XP will warn about 'Windows Logo testing', click 'Continue Anyway' to complete the installation.



The Autolog 3000 device driver is now installed and can be found as a new COM-port in the system.

1.6.4 USB Driver Installation (Windows 2000)

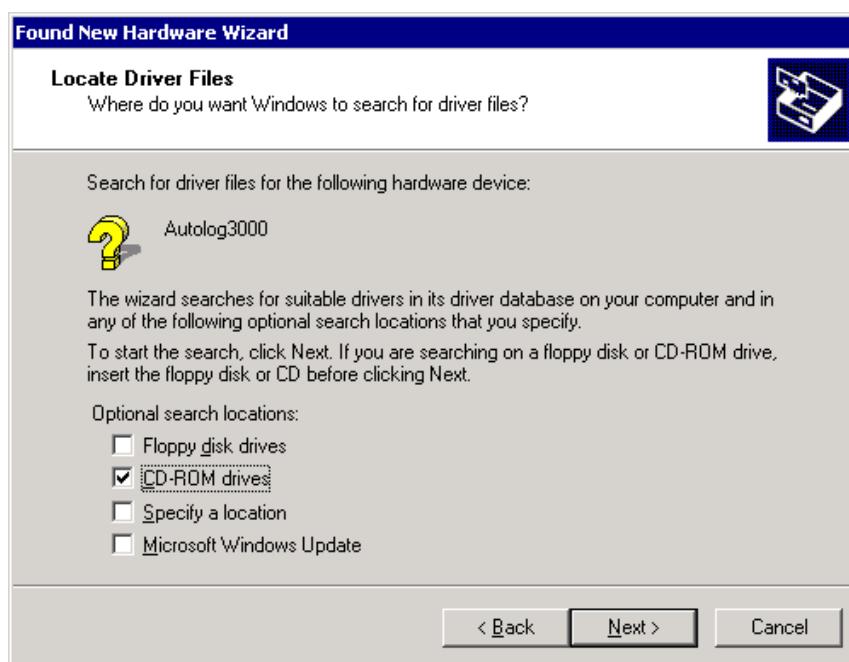
Start the PC, connect the Autolog 3000 to the PC using a USB cable and switch on the Autolog 3000. Windows will automatically detect a new device named 'USB – Autolog 3000' and show the following dialog:



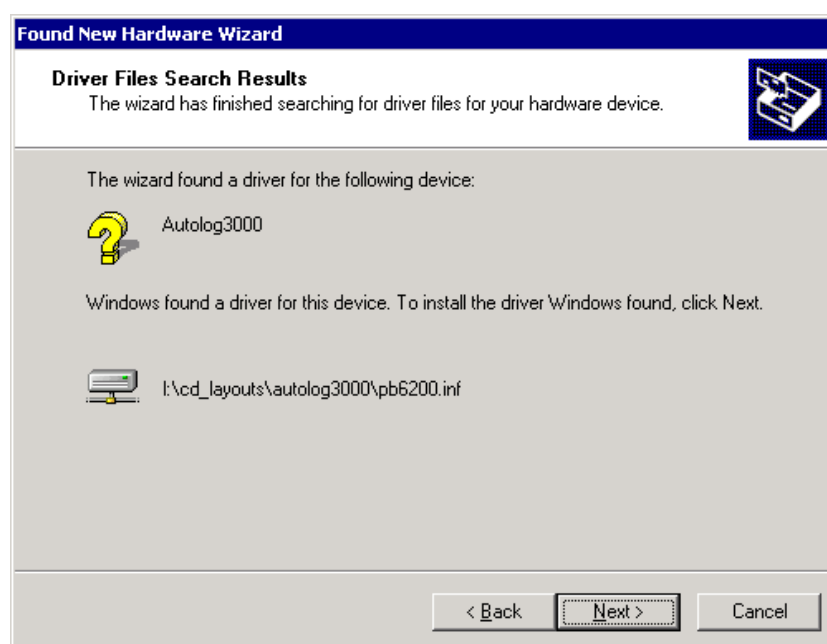
Click 'Next' to continue.

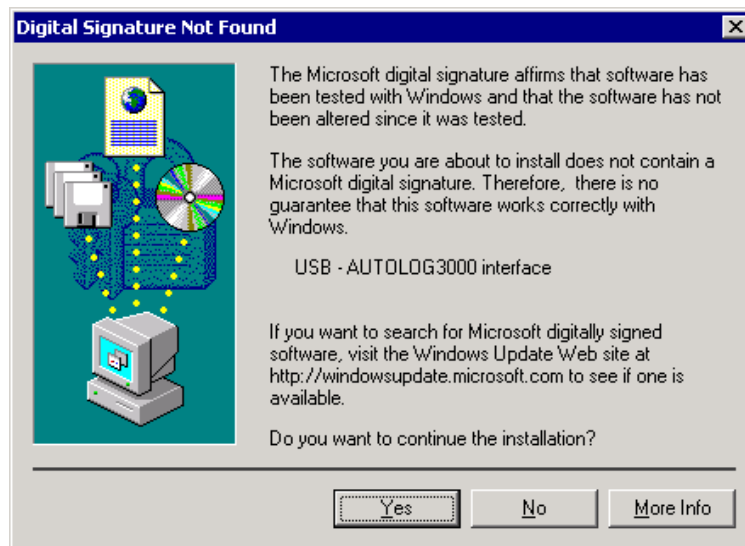


Now select 'Search for a suitable driver for my device (recommended)' and click 'Next'.

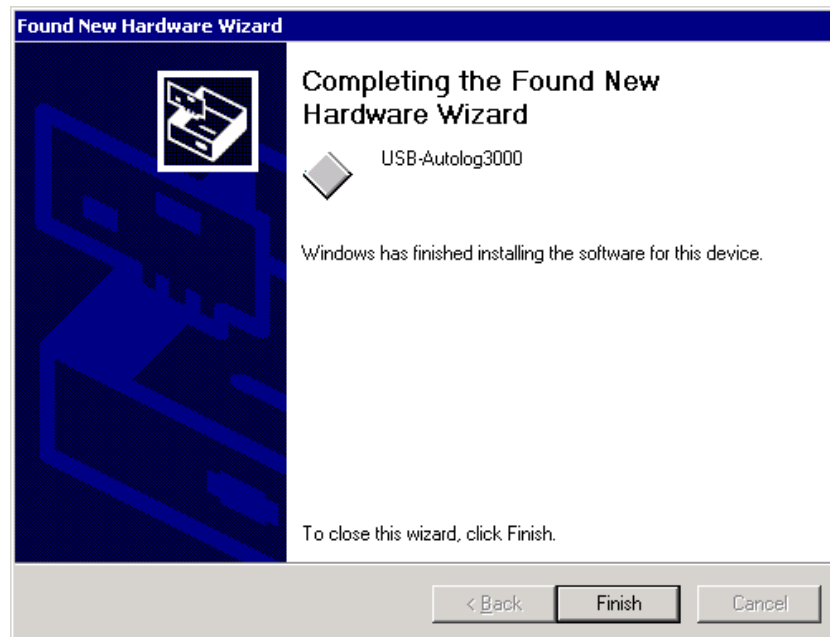


Check the 'CD-ROM drives' box and click 'Next'. The file 'pb6200.inf' should now be found as the driver installation file.





Windows XP will warn about 'Microsoft digital signature', click 'Yes' to complete the installation.



The Autolog 3000 device driver is now installed and can be found as a new COM-port in the system.

2 Autolog 3000 cards

2.1 CA3460 input card

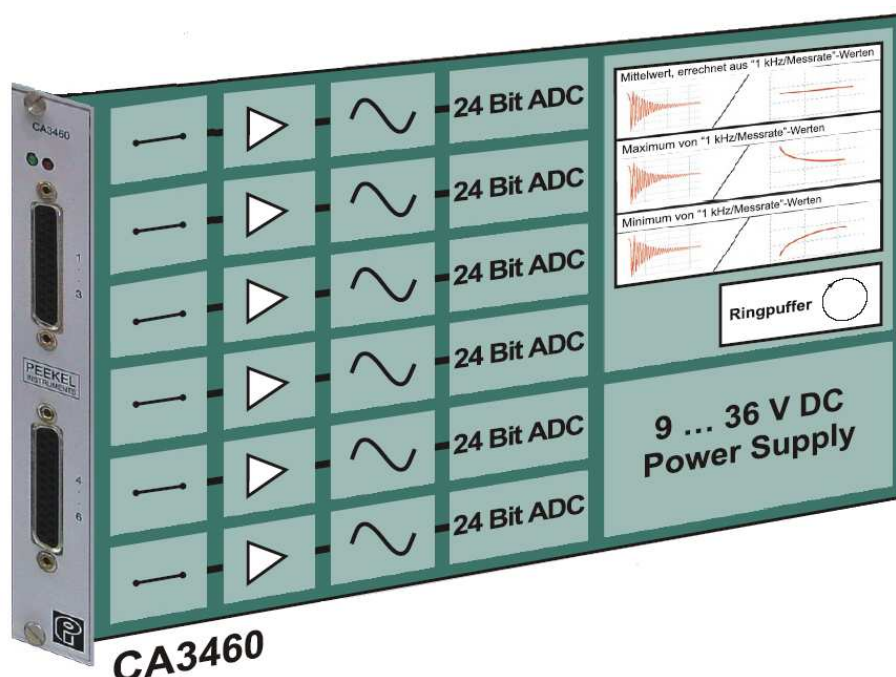
The CA3460 is a 6-channel DC input card for the Autolog 3000 system. It is designed to be used for high-accuracy experimental and industrial measurements and can be used with a variety of Wheatstone bridge-based sensors and DC input signals. This card contains 6 individual channels, and the card can be used in the AUTOLOG 3000 multi-channel system.

2.1.1 General design principles

In principle the CA3460 is a standalone 6-channel measuring system. The following functions are integrated on the card:

- a separate amplifier/conditioner for each channel including an A/D converter
- a microprocessor which controls the card hardware and reads the converted signal values from the AD converters
- DC/DC-converter which converts the large input range (9...36VDC) to the onboard necessary supply voltages
- CAN interface for the communication with an external system. The communication with an internal controller (USB or Ethernet) uses a faster internal bus.

The following drawing only shows the basic principles of the electronics, as it is outside the scope of this user's manual to go into full detail.



The CA3460 is the base board which can hold 2 optional extension boards.

2.1.1.1 Basic measurement

With the base board the following signals can be measured:

- Voltage signals: $\pm 40\text{mV}, \pm 2\text{V}$ or $\pm 10\text{V}$ range
- Current signals: $\pm 50\text{ mA}$ range
- Potentiometer 0 – 100% range
- PT100 $-200^{\circ}\text{C} - +590^{\circ}\text{C}$
- Thermocouple type B $+250^{\circ}\text{C} - +1820^{\circ}\text{C}$
- Thermocouple type E $-200^{\circ}\text{C} - +1000^{\circ}\text{C}$
- Thermocouple type J $-200^{\circ}\text{C} - +1200^{\circ}\text{C}$
- Thermocouple type K $-200^{\circ}\text{C} - +1370^{\circ}\text{C}$
- Thermocouple type N $-200^{\circ}\text{C} - +1300^{\circ}\text{C}$
- Thermocouple type R $-50^{\circ}\text{C} - +1760^{\circ}\text{C}$
- Thermocouple type S $-50^{\circ}\text{C} - +1760^{\circ}\text{C}$
- Thermocouple type T $-200^{\circ}\text{C} - +400^{\circ}\text{C}$
- Full Wheatstone bridge: $\pm 8\text{mV/V}$ or $\pm 400\text{mV/V}$

For the excitation of the potentiometer and full bridge measurement a 2,5V supply is present. The PT100 and resistor measurement is done with a ratio measurement to an on-board reference resistor. The maximum current through the resistor to be measured is about 250uA.

On the CA3460 2 optional extension boards can be mounted. Each of these boards will extend the signals which can be measured for 3 channels. The first extension board handles channel 1, 2 and 3, and the second extension board handles channel 4, 5 and 6.

2.1.1.2 Option 1 measurements

This extension board is used when bridge configurations other than the standard full bridge configuration must be measured, usually for strain gauge measurements. With this extension the following measurement configurations are added to the CA3460:

- Full bridge
- Half bridge
- Quarter bridge 120 Ω
- Quarter bridge 350 Ω
- Quarter bridge 1000 Ω

All these configurations will use the sense lines, to compensate the voltage drop over the wires used for the excitation of the external bridge. Full and half bridge configurations use a 6-wire connection, **quarter bridge uses a 4-wire connection.**

The excitation for the bridge is adjustable in steps of 0,5V from 0,5V up to 5V.

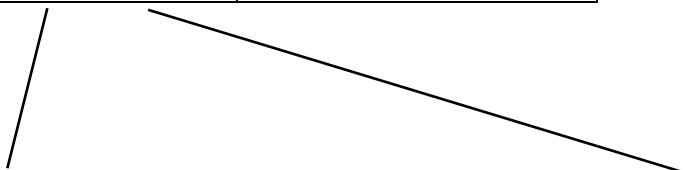
The maximum current for this excitation is 50 mA. When the current is above this level, the excitation voltage will automatically be reduced until the current is below 50 mA.

The measurement ranges are the same as on the base board. A selection can be made between $\pm 40\text{mV}$ and $\pm 2\text{V}$.

For bridge measurements the ranges are normally notated in mV/V , for strain gauge measurements $\mu\text{m/m}$ is used.

Some example values:

Input range	$\pm 40\text{mV}$	$\pm 2\text{V}$
Excitation		
0,5V - 5V	$\pm 8 \text{ mV/V}$	$\pm 400 \text{ mV/V}$



Input range	Full bridge K-factor = 2	Half bridge K-factor = 2	Quarter bridge K-factor = 2
Excitation	Bridge factor=4	Bridge factor=2	Bridge factor=1
0,5V - 5V	$\pm 3800 \mu\text{m/m}$	$\pm 7700 \mu\text{m/m}$	$\pm 15000 \mu\text{m/m}$

Note:

In the software from Peekel Instruments, the calculation of the available measurement range is done automatically, based on the settings (like excitation voltage) used, only the resulting range is shown.

2.1.1.3 Option 2 measurements

This extension board is used when LVDT sensor must be measured. With this extension the following measurement configurations are added to the CA3460:

- Full bridge LVDT
- Half bridge LVDT

All these configurations will use the sense lines, to compensate the voltage drop over the wires used for the excitation of the external bridge.

The excitation for the bridge is fixed 4V_{rms} with a frequency of 5kHz.

The maximum current for this excitation is 50 mA.

2.1.1.4 Card LED's

On the front of the card a red and a green LED are present. Those LED's have the following meaning:

Red LED: lights up when the card is on and correctly functioning

Green LED: lights up when communication to an external system is present

Note:

If the Autolog 3000 contains a built-in USB-controller, then the green LEDs will light up as soon as the device is connected through its USB interface and correctly recognized by the PC.

2.2 CM3410 input card

The CM3410 is a DC input card for the Autolog 3000 system.

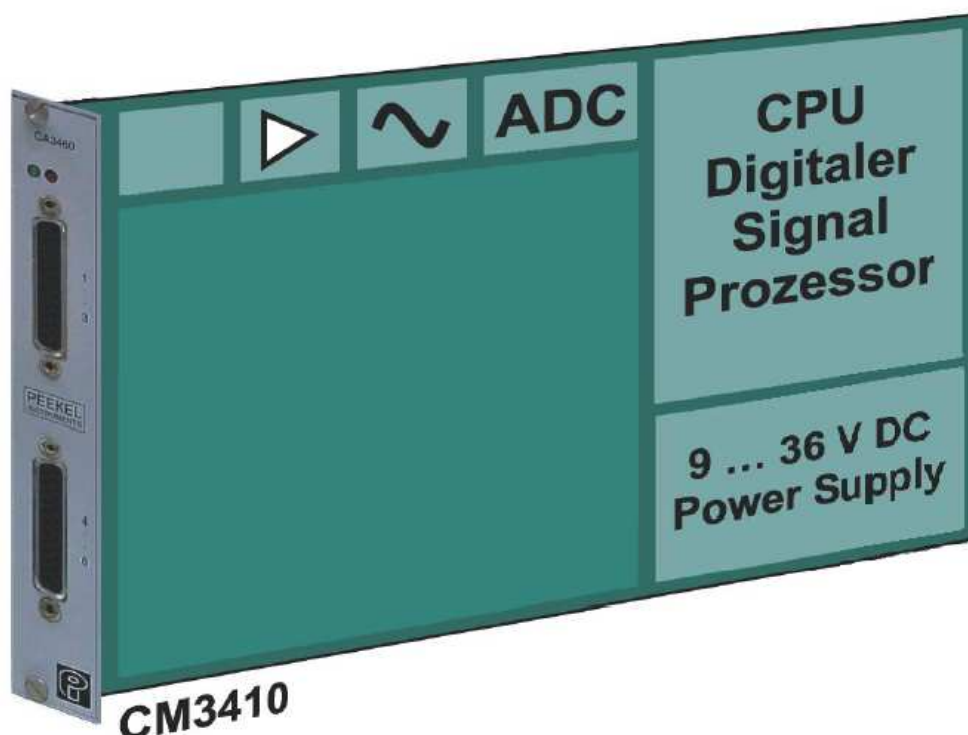
It is designed to be used for high-accuracy experimental and industrial measurements and can be used with a variety of Wheatstone bridge-based sensors and DC input signals. This card contains 1 individual channel identical as on the CA3460 card, extended with a multiplexer. This means the card offers up to 36 input channels. Every input channel can measure almost every type of sensor, from DCV/current and Thermocouples up to strain gauge bridges. The card can be used in the AUTOLOG 3000 multi-channel system.

2.2.1 General design principles

In principle the CM3410 is a standalone measuring system. The following functions are integrated on the card:

- a separate amplifier/conditioner including an A/D converter
- Multiplexer with 72 contacts (PhotoMOS-Relais); combined measurement speed: max. 200Hz
- a microprocessor which controls the card hardware and reads the converted signal values from the AD converter
- Power supply which converts the large input range (9...36 VDC) to the onboard necessary supply voltages
- CAN interface for the communication with an external system. The communication with an internal controller (USB or Ethernet) uses a faster internal bus.

The following drawing only shows the basic principles of the electronics, as it is outside the scope of this user's manual to go into full detail.



2.2.1.1 Basic measurement

With the base board the following signals can be measured:

- Voltage signals: $\pm 40\text{mV}, \pm 2\text{V}$ or $\pm 10\text{V}$ range
- Potentiometer 0 – 100% range
- PT100 $-200^{\circ}\text{C} - +590^{\circ}\text{C}$
- Thermocouple type B $+250^{\circ}\text{C} - +1820^{\circ}\text{C}$
- Thermocouple type E $-200^{\circ}\text{C} - +1000^{\circ}\text{C}$
- Thermocouple type J $-200^{\circ}\text{C} - +1200^{\circ}\text{C}$
- Thermocouple type K $-200^{\circ}\text{C} - +1370^{\circ}\text{C}$
- Thermocouple type N $-200^{\circ}\text{C} - +1300^{\circ}\text{C}$
- Thermocouple type R $-50^{\circ}\text{C} - +1760^{\circ}\text{C}$
- Thermocouple type S $-50^{\circ}\text{C} - +1760^{\circ}\text{C}$
- Thermocouple type T $-200^{\circ}\text{C} - +400^{\circ}\text{C}$
- Full bridge
- Half bridge
- Quarter bridge 120 Ω
- Quarter bridge 350 Ω
- Quarter bridge 1000 Ω

The excitation supply for the bridge measurements is adjustable between 0,5VDC and 5VDC. At 5 V excitation, the smallest resistance value that can be connected is 120 Ohms.

The PT100 and resistor measurement is done with a ratio measurement to an on-board reference resistor. The maximum current through the resistor to be measured is about 250uA.

2.2.1.2 Multiplexer

The multiplexer can be used to connect more channels to the single input channel. This input channel is the same as on the CA3460 and will use 8 wires for complete channel connection.

Those 8 wires are used for the next signals:

- Excitation supply (Vexc+ and Vexc-)
- Sense signal (Sense+ and Sense-)
- Input signal (Input+ and Input-)
- TEDS interface (SI+ and SI-)

All these signals are only used when a full bridge with TEDS information is used.

On the CM3410 9 of these channels can be connected.

When no TEDS is used, only 6 wires are required to connect a full bridge. Due to the flexibility of the multiplexer 12 of those channels can be connected.

A further increase of connecting channels will be the case when 4 wire or 2 wire measurements are used.

So a selection can be made between 8, 6, 4 or 2 wire measurements, which result in 9, 12, 18 or 36 signals to be connected to just 1 CM3410.

Due to this multiplexer layout, the function of an input pin on 1 of the 2 connectors will change when another type of connection is selected. When a 2 wire interface is selected, all

pin-pairs will be switched to the channel input circuit. When a 6 wire interface is selected some pin-pairs will be switched to the excitation supply. **Take care with this selection, because it is possible that excitation supply is set to connector pins, due to the chosen multiplexer setting. When in this case a thermocouple is connected to these pins, this thermocouple could short circuit the excitation supply, which could damage the thermocouple.**

The setup of the multiplexer is done in 3 groups, which means the total number of 72 contacts is divided into 3 times 24 contacts. For each group the number of connecting wires for the channels belonging to this group is identical. Therefore, the number of channels available in each group is calculated as follows:

$$24 \text{ contacts} / x \text{ wires per channel} = \text{number of channels available}$$

A special case is present for thermocouple measurement. When the cold-junction is to be used with this measurement this temperature is measured with a PT100 sensor which is connected as a 4 wire input. This is the last channel in the third group. All other channels will be 2 wire connections, which means there are $2 \times 12 + 1 \times 10 = 34$ thermocouple connection plus 1 CJC connection.

The following tables show how inputs should be connected, depending on the number of wires used in each group of channels. Note that for the second group, pins on both connector 1 and 2 are used.

Connections for the 1st group, depending on the number of wires used:
 (Note: 1-3-xx signifies channel #3 in group #1, for example)

Conn nr	Conn. pin	Channel nr 8 wire conn	Channels nr 6 wire conn	Channel nr 4 wire conn	Channel nr 2 wire conn
1	19	1-1- Vexc+	1-1- Vexc+	1-1- Vexc+	1-1- Input+
1	37	1-1- Vexc-	1-1- Vexc-	1-1- Vexc-	1-1- Input -
1	18	1-1- Sense+	1-1- Sense+	1-1- Input+	1-2- Input+
1	36	1-1- Sense-	1-1- Sense-	1-1- Input -	1-2- Input -
1	17	1-1- Input+	1-1- Input+	1-2- Vexc+	1-3- Input+
1	35	1-1- Input -	1-1- Input -	1-2- Vexc-	1-3- Input -
1	16	1-1- SI+	1-2- Vexc+	1-2- Input+	1-4- Input+
1	34	1-1- SI-	1-2- Vexc-	1-2- Input -	1-4- Input -
1	15	1-2- Vexc+	1-2- Sense+	1-3- Vexc+	1-5- Input+
1	33	1-2- Vexc-	1-2- Sense-	1-3- Vexc-	1-5- Input -
1	14	1-2- Sense+	1-2- Input+	1-3- Input+	1-6- Input+
1	32	1-2- Sense-	1-2- Input -	1-3- Input -	1-6- Input -
1	13	1-2- Input+	1-3- Vexc+	1-4- Vexc+	1-7- Input+
1	31	1-2- Input -	1-3- Vexc-	1-4- Vexc-	1-7- Input -
1	12	1-2- SI+	1-3- Sense+	1-4- Input+	1-8- Input+
1	30	1-2- SI-	1-3- Sense-	1-4- Input -	1-8- Input -
1	11	1-3- Vexc+	1-3- Input+	1-5- Vexc+	1-9- Input+
1	29	1-3- Vexc-	1-3- Input -	1-5- Vexc-	1-9- Input -
1	10	1-3- Sense+	1-4- Vexc+	1-5- Input+	1-10- Input+
1	28	1-3- Sense-	1-4- Vexc-	1-5- Input -	1-10- Input -
1	9	1-3- Input+	1-4- Sense+	1-6- Vexc+	1-11- Input+
1	27	1-3- Input -	1-4- Sense-	1-6- Vexc-	1-11- Input -
1	8	1-3- SI+	1-4- Input+	1-6- Input+	1-12- Input+
1	26	1-3- SI-	1-4- Input -	1-6- Input -	1-12- Input -

Connections for the 2nd group, depending on the number of wires used:
 (Note: 2-3-xx signifies channel #3 in group #2, for example)

Conn nr	Conn. pin	Channel nr 8 wire conn	Channels nr 6 wire conn	Channel nr 4 wire conn	Channel nr 2 wire conn
1	7	2-1- Vexc+	2-1- Vexc+	2-1- Vexc+	2-1- Input+
1	25	2-1- Vexc-	2-1- Vexc-	2-1- Vexc-	2-1- Input -
1	6	2-1- Sense+	2-1- Sense+	2-1- Input+	2-2- Input+
1	24	2-1- Sense-	2-1- Sense-	2-1- Input -	2-2- Input -
1	5	2-1- Input+	2-1- Input+	2-2- Vexc+	2-3- Input+
1	23	2-1- Input -	2-1- Input -	2-2- Vexc-	2-3- Input -
1	4	2-1- SI+	2-2- Vexc+	2-2- Input+	2-4- Input+
1	22	2-1- SI-	2-2- Vexc-	2-2- Input -	2-4- Input -
1	3	2-2- Vexc+	2-2- Sense+	2-3- Vexc+	2-5- Input+
1	21	2-2- Vexc-	2-2- Sense-	2-3- Vexc-	2-5- Input -
1	2	2-2- Sense+	2-2- Input+	2-3- Input+	2-6- Input+
1	20	2-2- Sense-	2-2- Input -	2-3- Input -	2-6- Input -
2	19	2-2- Input+	2-3- Vexc+	2-4- Vexc+	2-7- Input+
2	37	2-2- Input -	2-3- Vexc-	2-4- Vexc-	2-7- Input -
2	18	2-2- SI+	2-3- Sense+	2-4- Input+	2-8- Input+
2	36	2-2- SI-	2-3- Sense-	2-4- Input -	2-8- Input -
2	17	2-3- Vexc+	2-3- Input+	2-5- Vexc+	2-9- Input+
2	35	2-3- Vexc-	2-3- Input -	2-5- Vexc-	2-9- Input -
2	16	2-3- Sense+	2-4- Vexc+	2-5- Input+	2-10- Input+
2	34	2-3- Sense-	2-4- Vexc-	2-5- Input -	2-10- Input -
2	15	2-3- Input+	2-4- Sense+	2-6- Vexc+	2-11- Input+
2	33	2-3- Input -	2-4- Sense-	2-6- Vexc-	2-11- Input -
2	14	2-3- SI+	2-4- Input+	2-6- Input+	2-12- Input+
2	32	2-3- SI-	2-4- Input -	2-6- Input -	2-12- Input -

Connections for the 3rd group, depending on the number of wires used:

(Note: 3-4-xx signifies channel #4 in group #3, for example)

Conn nr	Conn. pin	Channel nr 8 wire conn	Channels nr 6 wire conn	Channel nr 4 wire conn	Channel nr 2 wire conn	Channel nr 2 wire+CJC
2	13	3-1- Vexc+	3-1- Vexc+	3-1- Vexc+	3-1- Input+	3-1- Input+
2	31	3-1- Vexc-	3-1- Vexc-	3-1- Vexc-	3-1- Input -	3-1- Input -
2	12	3-1- Sense+	3-1- Sense+	3-1- Input+	3-2- Input+	3-2- Input+
2	30	3-1- Sense-	3-1- Sense-	3-1- Input -	3-2- Input -	3-2- Input -
2	11	3-1- Input+	3-1- Input+	3-2- Vexc+	3-3- Input+	3-3- Input+
2	29	3-1- Input -	3-1- Input -	3-2- Vexc-	3-3- Input -	3-3- Input -
2	10	3-1- SI+	3-2- Vexc+	3-2- Input+	3-4- Input+	3-4- Input+
2	28	3-1- SI-	3-2- Vexc-	3-2- Input -	3-4- Input -	3-4- Input -
2	9	3-2- Vexc+	3-2- Sense+	3-3- Vexc+	3-5- Input+	3-5- Input+
2	27	3-2- Vexc-	3-2- Sense-	3-3- Vexc-	3-5- Input -	3-5- Input -
2	8	3-2- Sense+	3-2- Input+	3-3- Input+	3-6- Input+	3-6- Input+
2	26	3-2- Sense-	3-2- Input -	3-3- Input -	3-6- Input -	3-6- Input -
2	7	3-2- Input+	3-3- Vexc+	3-4- Vexc+	3-7- Input+	3-7- Input+
2	25	3-2- Input -	3-3- Vexc-	3-4- Vexc-	3-7- Input -	3-7- Input -
2	6	3-2- SI+	3-3- Sense+	3-4- Input+	3-8- Input+	3-8- Input+
2	24	3-2- SI-	3-3- Sense-	3-4- Input -	3-8- Input -	3-8- Input -
2	5	3-3- Vexc+	3-3- Input+	3-5- Vexc+	3-9- Input+	3-9- Input+
2	23	3-3- Vexc-	3-3- Input -	3-5- Vexc-	3-9- Input -	3-9- Input -
2	4	3-3- Sense+	3-4- Vexc+	3-5- Input+	3-10- Input+	3-10- Input+
2	22	3-3- Sense-	3-4- Vexc-	3-5- Input -	3-10- Input -	3-10- Input -
2	3	3-3- Input+	3-4- Sense+	3-6- Vexc+	3-11- Input+	3-11- Vexc +
2	21	3-3- Input -	3-4- Sense-	3-6- Vexc-	3-11- Input -	3-11- Vexc -
2	2	3-3- SI+	3-4- Input+	3-6- Input+	3-12- Input+	3-11- Input+
2	20	3-3- SI-	3-4- Input -	3-6- Input -	3-12- Input -	3-11- Input -

2.3 CD3733 Digital In- output card

The CD3733 is a in- and output card for the Autolog 3000 system. It is designed to be used for 24VDC optoisolated status inputs and solid state relay outputs.

The card can be used in the AUTOLOG 3000 multi-channel system.

2.3.1 General design principles

In principle the CD3733 is a standalone measuring system. The following functions are integrated on the card:

- 16 digital status inputs, opto isolated
- 12 digital status outputs, solid state contact
- 2 digital status output with a NO-NC relay contact
- a microprocessor which controls the card hardware
- Power supply which converts the large input range (9...36 VDC) to the onboard necessary supply voltages
- CAN interface for the communication with an external system. The communication with an internal controller (USB or Ethernet) uses a faster internal bus.



2.4 PB3000 Ethernet interface card

The PB3000 will add an Ethernet connection to the Autolog 3000 system. Optionally, this card also makes it possible to use the Autolog 3000 system without an external PC. This card can be used in a 3003, 3008 or 3016 cabinet; in each case a single slot will be used up by the card.

2.4.1 General design principles

On the card an embedded PC is mounted. On this PC the application is running under the control of Windows XP embedded.

The application is a interface between the standard USB connection to the Autolog cabinet and the Ethernet interface.

The software on the card boots from the onboard CF card

Depending on the application, there are two different ways to utilise this card:

- a) Autolog 3000 operates as an Ethernet-device and is controlled by an external PC over an Ethernet-network.
- b) Optionally (internal hard disk required), the Autolog 3000 can be configured to run stand-alone using the PB3000 as an Embedded PC to run the measurement software. Measurement data can then be stored on the internal hard disk.

The VGA and USB connectors can be used to connect a monitor and mouse/keyboard to control the Embedded PC, this is not needed when the Autolog 3000 operates as an Ethernet device.



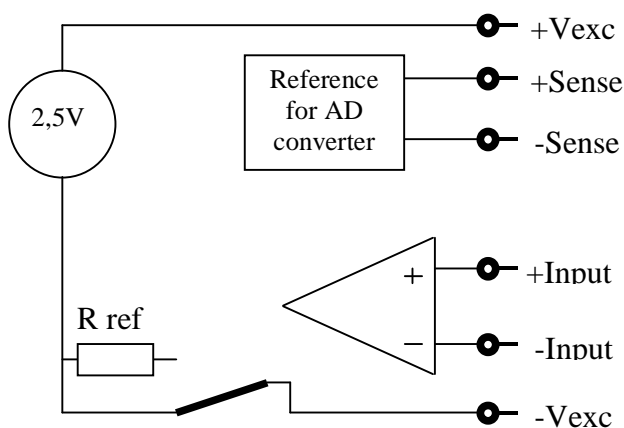
3 Autolog 3000 signal connections

To clarify how input signal are handled by the hardware of the input cards, a short overview is presented for each type of sensor.

Connections are drawn simplified for clarity.

3.1 Signal connection CA3460 and CM3410 board

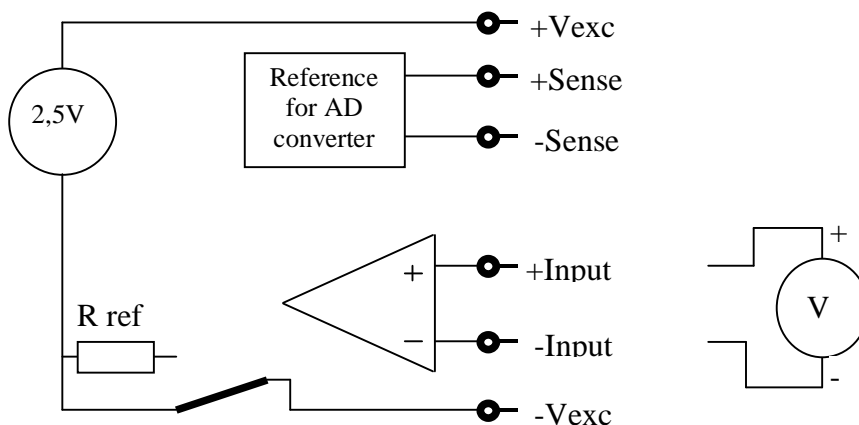
Each input has the following internal connections:



Notes to the sensor cable:

- In order to reduce the noise, all the connections to the input must be made with **screened cable**. The cable screen must be connected in a proper way to the cable connector metal housing.
- It is preferred to use **twisted pairs** for the signal pairs (Vexc, input, sense).

3.1.1 Voltage input connection

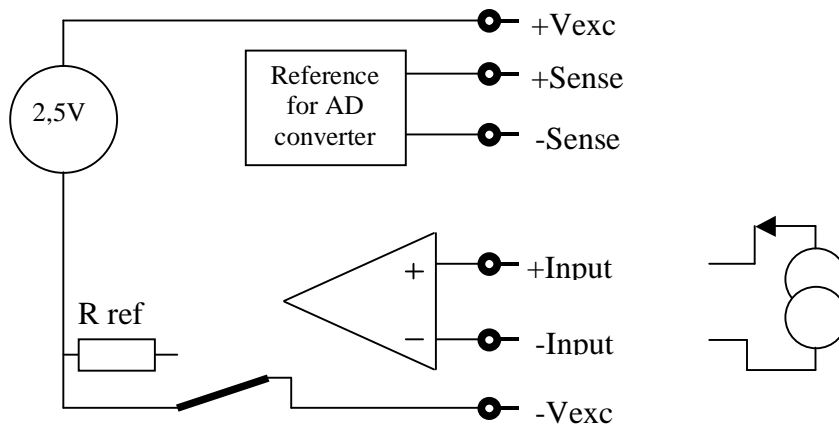


The voltage at the input pins must not exceed $\pm 15\text{V}$.

Note for the use of sensors which contain built-in electronics:

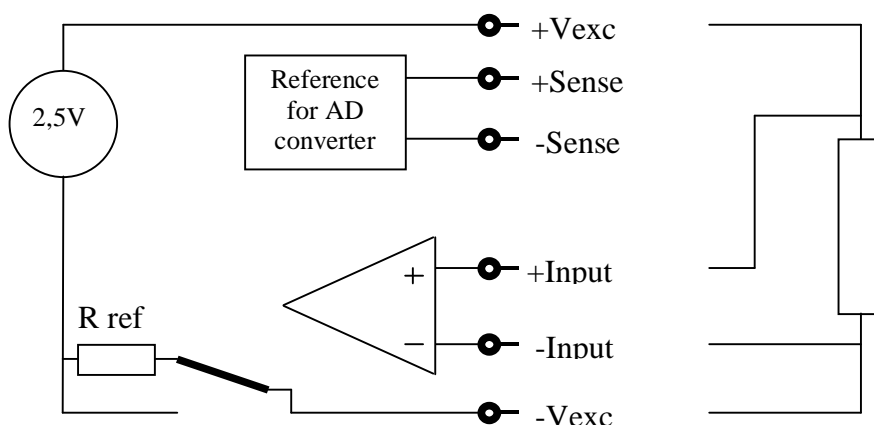
These types of sensor usually need a 24 VDC power supply. The Autolog 3000 card can not deliver this supply power, which means an external power supply is required.

In this case it is important that a connection is made between the analog ground of the measurement card (pin 1) and the 0V of the 24 V external power supply.

3.1.2 Current input connection (CA3460 only)

When the current measurement is selected, a 22Ω resistor is switched between the + and – input terminals on the CA3460 board. The maximum current is 50 mA. When this current is higher, the input resistance will increase to reduce the current and power dissipation in the 22Ω resistor. **Care must be taken that the maximum voltage on the input terminals does not exceed $\pm 15V$!**

Please note the remark about the use of sensors with built-in electronics above!

3.1.3 PT100/resistor connection

For the PT100 or resistor measurement a ratio metric measurement is done with the onboard reference resistor. The external resistor is connected in series with the internal resistor ($10\text{ k}\Omega$) to the 2.5V supply. The maximum current through the external resistor is 250 μA when the external resistor is 0Ω .This current will be lower when the external resistor is higher.

3.1.4 Potentiometer connection

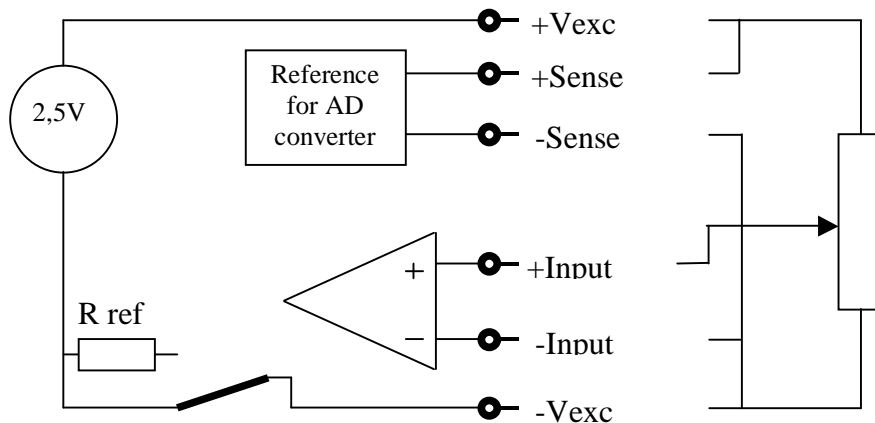


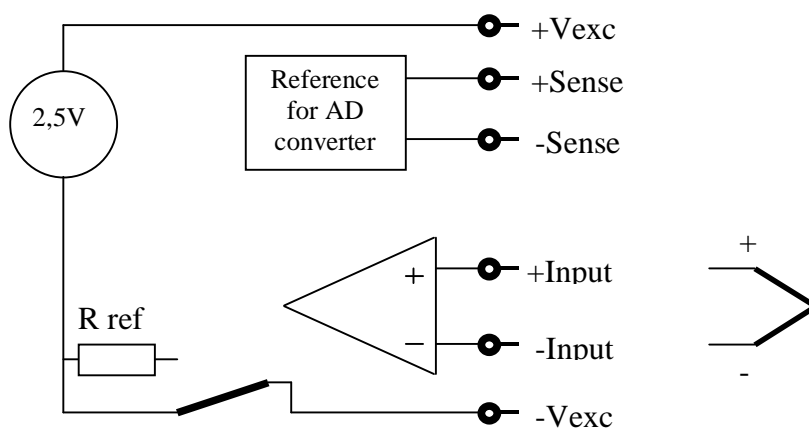
Figure 13: Potentiometer connection

The measurement of potentiometers usually uses 3 wires: +Excitation, -Excitation and centre tap for the signal.

For measurement with the Autolog 3000 the excitation wires should be looped through to the inputs as shown above, to ensure an accurate potentiometer-measurement. The minimum potentiometer resistance value is 60 Ω .

3.1.5 Thermocouple connection

The measurement of a thermocouple is basically the same as the measurement of a voltage signal.



With this measurement only the thermo voltage is measured. The cold junction temperature must be known to the system to generate the real temperature of the thermocouple point. This cold junction temperature must be measured by another channel. This channel can be on-board of this CA3460, but it is also possible that this measurement is done on a channel of another CA3460. In this case the cards must be on the same CAN bus, because the cold junction temperature is distributed over the CAN bus.

Burn Out Detection

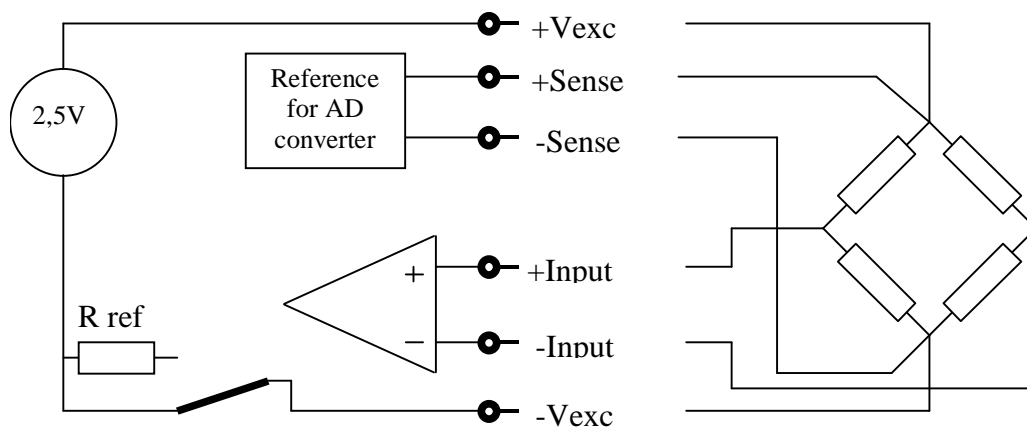
It is possible to set a Burn Out Detection on a thermocouple channel. When this option is selected the + wire is pulled up through a 10 M Ω resistor. When the thermocouple is not connected this wire will be at high level, and the measured temperature will be the maximum value of the selected thermocouple type.

If the Burn Out Detection is not active, a broken thermocouple will result in an open input. Because the measured value of an open input is undefined, any temperature value may be shown. Worst case, the temperature may not be recognisably incorrect.

Note:

However this Burn Out Detection can also influence the measurement when the thermocouple has a high impedance. This will not be the case with normal thermocouples, but there are e.g. non-contacting IR sensors with an internal resistance of about 3 k Ω . With such sensors the burn out detection will form a resistor divider and the measurement will be wrong. To have a correct measurement result, the Burn Out detection must be switched off.

3.1.6 Full bridge connection CA3460 base board

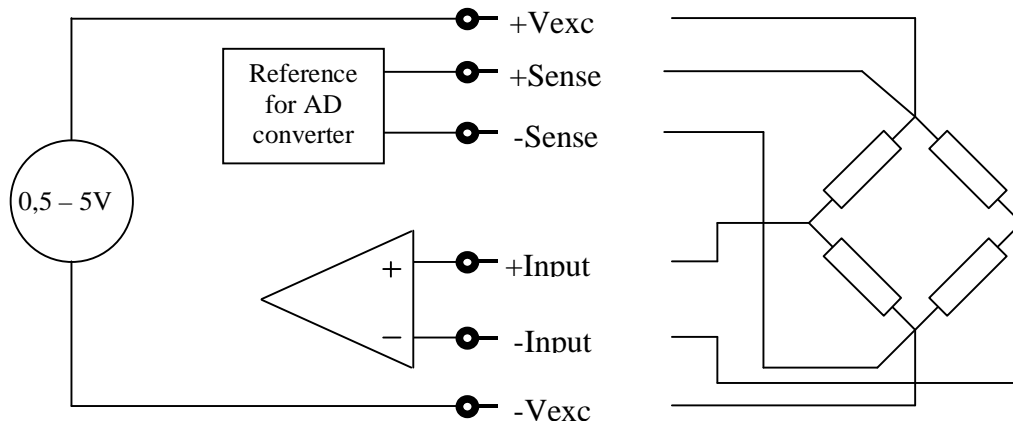


For this measurement on the base board the excitation is fixed on 2,5V. The sense lines must be connected either directly on the connector or through the cable on the bridge.

These sense lines will lead the voltage to the AD converter as a reference. By this way the voltage drop on the excitation lines will be eliminated.

The minimum allowable full bridge resistance (load) is 60 Ω .

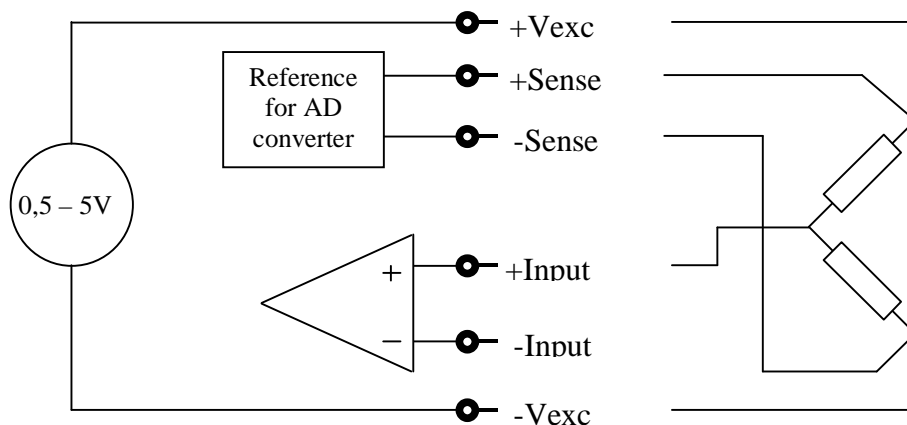
3.1.7 Full-bridge CA3460 option 1 & CM3410



Both the CA3460 with option 1 and the CM3410 multiplexer card have a configurable bridge supply voltage between 0.5 and 5 V in steps of 0.5 V. Note that a maximum current of 50 mA is supplied, which means that e.g. a $< 120 \Omega$ full bridge can not be measured at the maximum 5V bridge supply voltage. The voltage on the sense lines is used as a reference of the AD converter. In this way a true V/V measurement is done. Because of this measurement principle, the actual value of the excitation voltage is not important. Voltage drops on the excitation wires are not compensated by an increase of the excitation voltage.

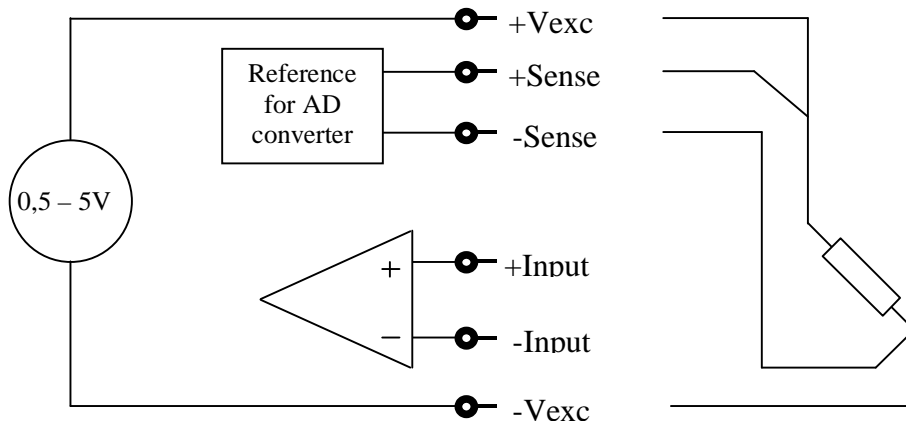
When the sense lines are not used, the $-sense$ must be connected to the $-V_{exc}$ and the $+sense$ must be connected to the $+V_{exc}$.

3.1.8 Half-bridge CA3460 option 1 & CM3410



When this measurement is selected an internal half bridge is used to complement the circuit to a full bridge. The internal half bridge is switched between the voltage levels of the sense lines. In this way the internal half bridge is at the same voltage levels as the external half bridge. The internal half bridge complementation resistors have a resistance of 1000Ω . The bridge supply voltage can be set between 0.5 and 5 V in steps of 0.5 V. Note that a maximum current of 50 mA is supplied.

3.1.9 Quarter-bridge CA3460 option 1 & CM3410



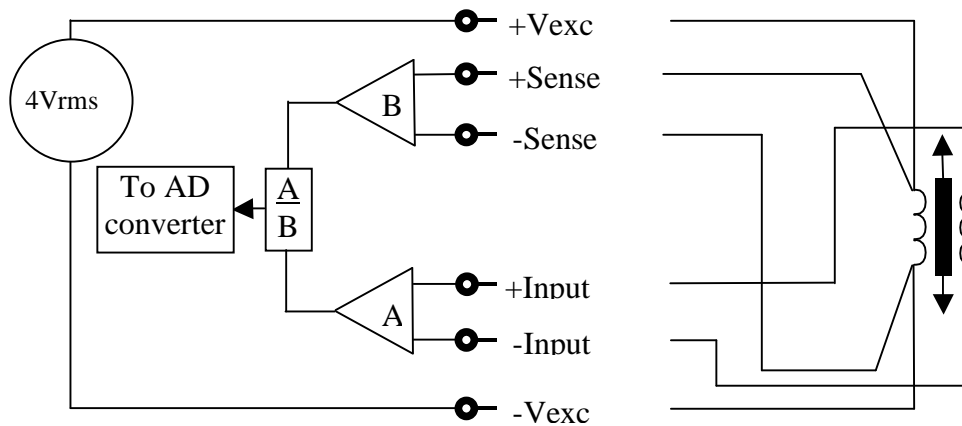
The single external resistor is complemented with 3 internal resistors to get a complete full bridge. Two precision resistors of 1000 Ohms build an internal half bridge, a third internal precision resistor completes the quarter bridge complementation and can be chosen as 120 Ω , 350 Ω or 1000 Ω to match the resistance value of the strain gauge (see manufacturer details). The bridge supply voltage can be set between 0.5 and 5 V in steps of 0.5 V. Note that a maximum current of 50 mA is supplied.

For this measurement the 4 wire principle is used, which will eliminate all the losses in the cabling. This means that the sense wires should be separate from the excitation wires and connected as close to the strain gauge as possible. Bridging the connections at the card instead of at the strain gauge will result in less accurate measurements because cable losses can not be compensated in this case.

Important note:

When using 2-wire connections between strain gauge and measurement device, every meter of this 2-wire connection is directly connected in series with the strain gauge. This has consequences for the sensitivity of the S/G and also means that every change in resistance in the wires, e.g. caused by temperature changes, will be interpreted as strain. The exact influence this has on the accuracy of the measurement depends on the resistance of the cable (cross sectional area times length) and the resistance of the strain gauge.

3.1.10 Full-bridge LVDT CA3460 Option 2



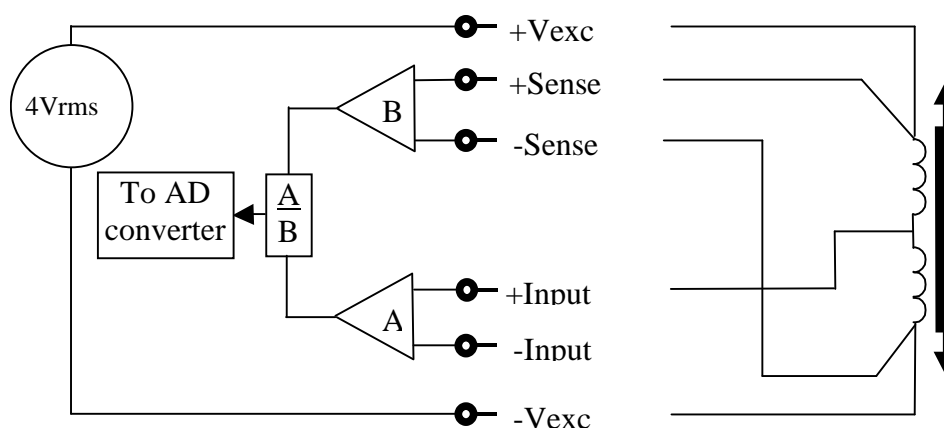
The voltage on the sense lines is used as a reference of the measurement. In this way a true V/V measurement is done. Because of this measurement principle, the actual value of the excitation voltage is not important. Voltage drops on the excitation wires are not compensated by an increase of the excitation voltage.

When the sense lines are not used, the -sense must be connected to the -Vexc and the +sense must be connected to the +Vexc.

Note for option 2:

Whether or not option 2 is used, the base functionality of the card will still be available, and is extended with Carrier Frequency technology.

3.1.11 Half-bridge LVDT CA3460 Option 2



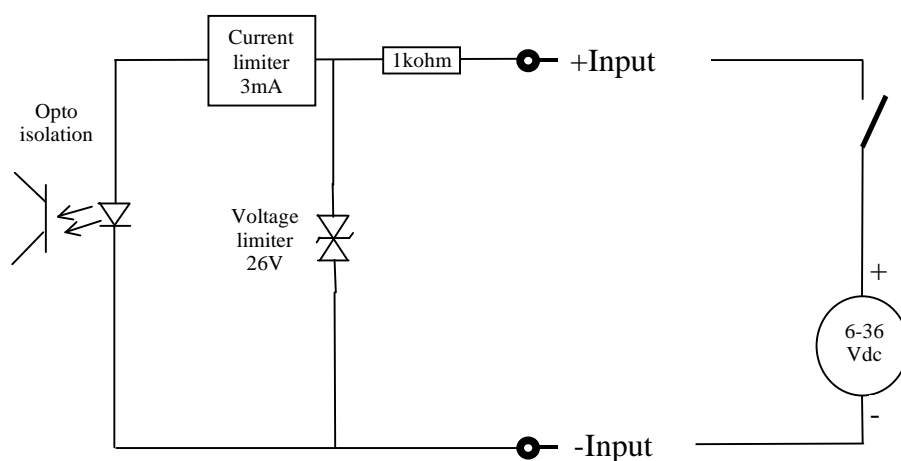
The voltage on the sense lines is used as a reference of the measurement. In this way a true V/V measurement is done. Because of this measurement principle, the actual value of the excitation voltage is not important. Voltage drops on the excitation wires are not compensated by an increase of the excitation voltage.

The -Input is connected to 0V on board.

When the sense lines are not used, the –sense must be connected to the –Vexc and the +sense must be connected to the +Vexc.

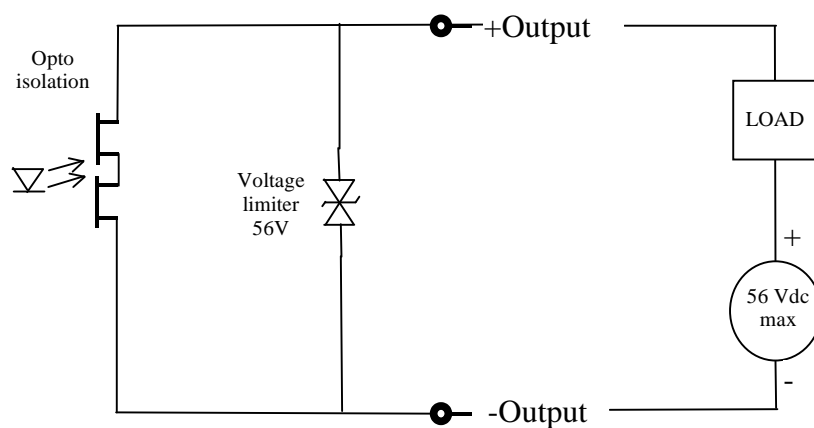
3.2 Signal connection CD3733 board

3.2.1 Digital input connection



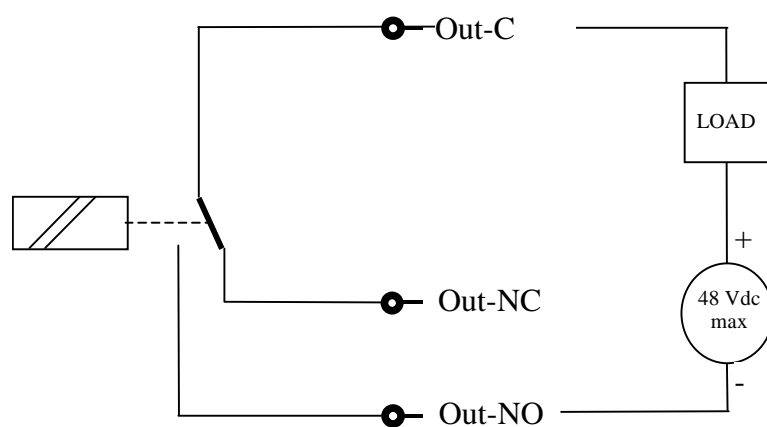
The voltage at the input pins must not exceed 36V.

3.2.2 Solid state output connection



The voltage on the output pins must not exceed 48V.

3.2.3 Relay output connection



The voltage on the output pins must not exceed 48V.

4 Connection diagrams

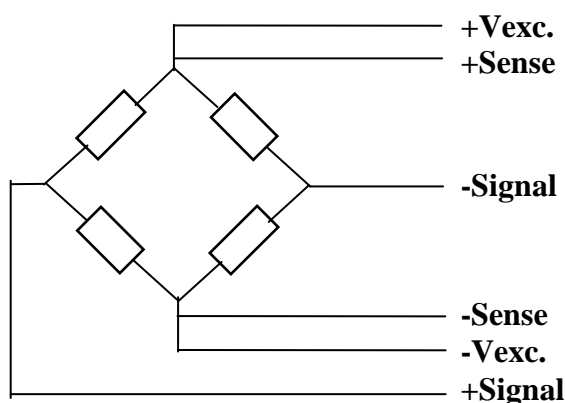
4.1 CA3460 and CM3410 board

The connection diagram for these boards are identical. The connection pin are different. At each diagram en separate table is noted for the connection of the CA3460 card and the CM3410 card.

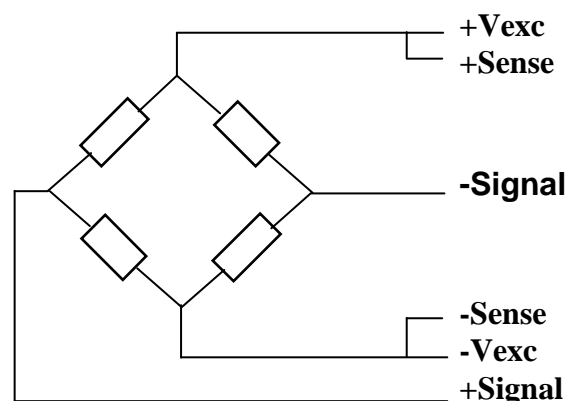
When twisted cable is used for the connection of the sensor the following signals must be used in a wire pair: Vexc+/-, Sense+/-, and Signal +/-

4.1.1 Full bridge

6-wire diagram



4-wire diagram

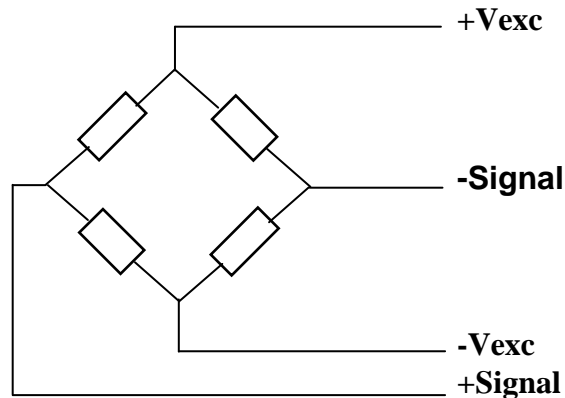


Channel nr at CA3460-Card		25 pins DSUB-Connector PIN-connection (PIN 1 = Analog GND)					
Plug-on 1...3	Plug-on 4...6	+Vexc	-Vexc	+Sense	-Sense	+Signal	-Signal
1	4	13	25	12	24	11	23
2	5	9	21	8	20	7	19
3	6	5	17	4	16	3	15

Channel nr at CM3410-Card		37 pins DSUB-Connector PIN-connection					
Conn1 Group-Channel	Conn2 Group-Channel	+Vexc	-Vexc	+Sense	-Sense	+Signal	-Signal
1-1	2-3	19	37	18	36	17	35
1-2	2-4	16	34	15	33	14	32
1-3	3-1	13	31	12	30	11	29
1-4	3-2	10	28	9	27	8	26
2-1	3-3	7	25	6	24	5	23
2-2	3-4	4	22	3	21	2	20

With the CM3410 it is also possible to measure the full bridge in a real 4 wire connection. The measurement principle is the same as a 6 wire connection with links on the connector between the excitation pins and the sense pins. Losses due to cable length and/or connector resistance are not eliminated. The resulting measurement error depends on the cable resistance (cross sectional area times length) and bridge resistance. The only advantage of using 4-wire connections is the ability to connect more channels to each CM3410 card (18 x 4-wire versus 12 x 6-wire).

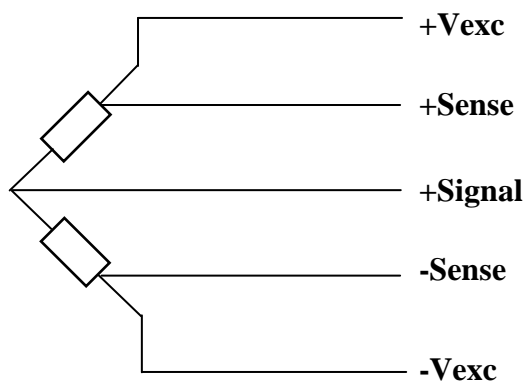
4 wire connection diagram



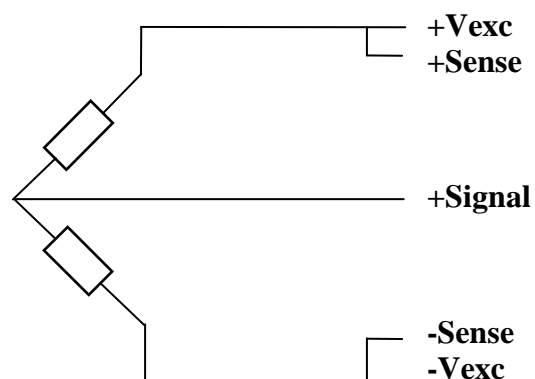
Channel nr at CM3410-Card		37 pins DSUB-Connector PIN-connection			
Conn1 Group-Channel	Conn2 Group-Channel	+Vexc	-Vexc	+Signal	-Signal
1-1	2-4	19	37	18	36
1-2	2-5	17	35	16	34
1-3	2-6	15	33	14	32
1-4	3-1	13	31	12	30
1-5	3-2	11	29	10	28
1-6	3-3	9	27	8	26
2-1	3-4	7	25	6	24
2-2	3-5	5	23	4	22
2-3	3-6	3	21	2	20

4.1.2 Half bridge (only CA3460 Option 1 & CM3410)

5- wire diagram



3- wire diagram



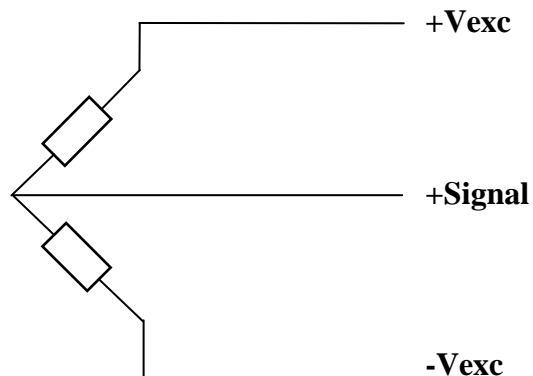
Channel nr at CA3460-Card		25 pins DSUB-Connector PIN-connection (PIN 1 = GND)				
Plug-on 1...3	Plug-on 4...6	+Vexc	-Vexc	+Sense	-Sense	+Signal
1	4	13	25	12	24	11
2	5	9	21	8	20	7
3	6	5	17	4	16	3

Channel nr at CM34100-Card		37 pins DSUB-Connector PIN-connection				
Conn1 Group-Channel	Conn2 Group-Channel	+Vexc	-Vexc	+Sense	-Sense	+Signal
1-1	2-3	19	37	18	36	17
1-2	2-4	16	34	15	33	14
1-3	3-1	13	31	12	30	11
1-4	3-2	10	28	9	27	8
2-1	3-3	7	25	6	24	5
2-2	3-4	4	22	3	21	2

The “**Signal**” is connected to the on board half bridge complementation resistors.

With the CM3410 it is also possible to measure the half bridge in a real 3 wire connection. The measurement principle is the same as a 5 wire connection with links on the connector between the excitation pins and the sense pins. Losses due to cable length and/or connector resistance are not eliminated. The resulting measurement error depends on the cable resistance (cross sectional area times length) and bridge resistance. The only advantage of using 3-wire connections is the ability to connect more channels to each CM3410 card (18 x 4-wire versus 12 x 6-wire).

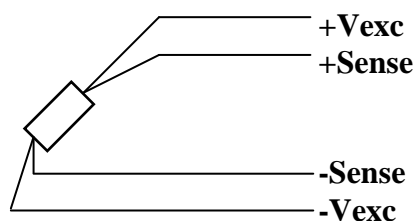
3 wire connection diagram



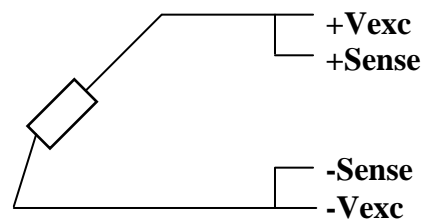
Channel nr at CM3410-Card		37 pins DSUB-Connector PIN-connection		
Conn1 Group-Channel	Conn2 Group-Channel	+Vexc	-Vexc	+Signal
1-1	2-4	19	37	18
1-2	2-5	17	35	16
1-3	2-6	15	33	14
1-4	3-1	13	31	12
1-5	3-2	11	29	10
1-6	3-3	9	27	8
2-1	3-4	7	25	6
2-2	3-5	5	23	4
2-3	3-6	3	21	2

4.1.3 Quarter bridge (only CA3460 Option 1 & CM3410)

4-wire diagram



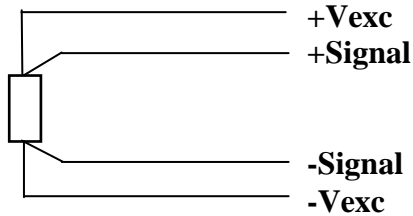
2-Wire diagram



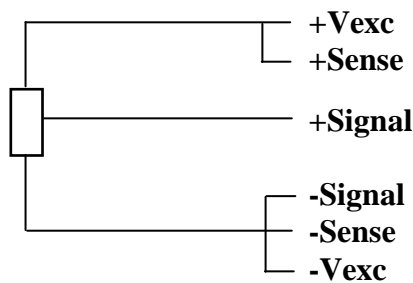
Channel nr at CA3460-Card		25 pins DSUB-Connector PIN-connection (PIN 1 = GND)					
Plug-on 1...3	Plug-on 4...6	+Vexc	-Vexc	+Sense	-Sense	+Signal	-Signal
1	4	13	25	12	24	11	23
2	5	9	21	8	20	7	19
3	6	5	17	4	16	3	15

Channel nr at CM3410-Card		37 pins DSUB-Connector PIN-connection			
Conn1 Group-Channel	Conn2 Group-Channel	+Vexc	-Vexc	+Sense	-Sense
1-1	2-4	19	37	18	36
1-2	2-5	17	35	16	34
1-3	2-6	15	33	14	32
1-4	3-1	13	31	12	30
1-5	3-2	11	29	10	28
1-6	3-3	9	27	8	26
2-1	3-4	7	25	6	24
2-2	3-5	5	23	4	22
2-3	3-6	3	21	2	20

4.1.4 Resistor measurement (Pt100)



4.1.5 Potentiometer measurement



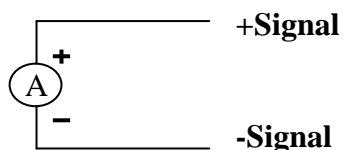
Channel nr at CA3460-Card		25 pins DSUB-Connector PIN-connection (PIN 1 = GND)					
Plug-on 1...3	Plug-on 4...6	+Vexc	-Vexc	+Sense	-Sense	+Signal	-Signal
1	4	13	25	12	24	11	23
2	5	9	21	8	20	7	19
3	6	5	17	4	16	3	15

Channel nr at CM3410-Card		37 pins DSUB-Connector PIN-connection			
Conn1 Group-Channel	Conn2 Group-Channel	+Vexc	-Vexc	+Signal	-Signal
1-1	2-4	19	37	18	36
1-2	2-5	17	35	16	34
1-3	2-6	15	33	14	32
1-4	3-1	13	31	12	30
1-5	3-2	11	29	10	28
1-6	3-3	9	27	8	26
2-1	3-4	7	25	6	24
2-2	3-5	5	23	4	22
2-3	3-6	3	21	2	20

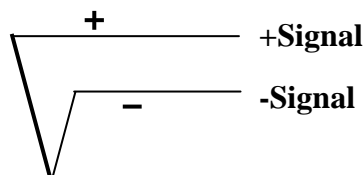
4.1.6 Voltage input



4.1.7 Current input (CA3460 only)



4.1.8 Thermocouple



Note for the use of sensors which contain built-in electronics:

These types of sensor usually need a 24 VDC power supply. The Autolog 3000 card can not deliver this supply power, which means an external power supply is required.

In this case it is important that a connection is made between the analog ground of the measurement card (pin 1) and the 0V of the 24 V external power supply.

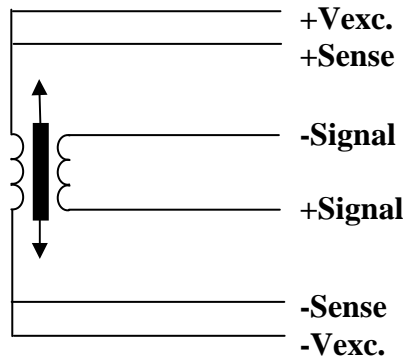
Channel nr at CA3460-Card		25 pins DSUB-Connector PIN-connection (PIN 1 = GND)					
Plug-on 1...3	Plug-on 4...6	+Vexc	-Vexc	+Sense	-Sense	+Signal	-Signal
1	4	13	25	12	24	11	23
2	5	9	21	8	20	7	19
3	6	5	17	4	16	3	15

Channel nr at CM3410-Card		37 DSUB-Connector PIN-connection	
Conn1 Channel	Conn2 Channel	+Signal	-Signal
1-1	2-7	19	37
1-2	2-8	18	36
1-3	2-9	17	35
1-4	2-10	16	34
1-5	2-11	15	33
1-6	2-12	14	32
1-7	3-1	13	31
1-8	3-2	12	30
1-9	3-3	11	29

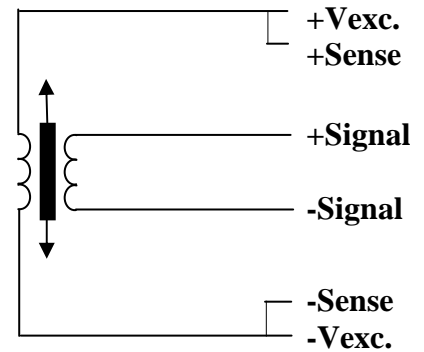
Channel nr at CM3410-Card		37 DSUB-Connector PIN-connection	
Conn1 Channel	Conn2 Channel	+Signal	-Signal
1-10	3-4	10	28
1-11	3-5	9	27
1-12	3-6	8	26
2-1	3-7	7	25
2-2	3-8	6	24
2-3	3-9	5	23
2-4	3-10	4	22
2-5	3-11	3	21
2-6	3-12	2	20

4.1.9 Full bridge LVDT (only CA3460 Option 2)

6-wire diagram

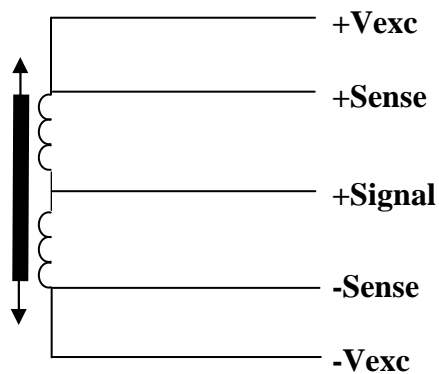


4-wire diagram

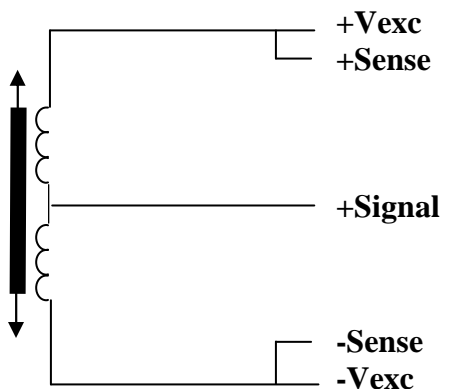


4.1.10 Half bridge LVDT (only CA3460 Option 2)

5- wire diagram



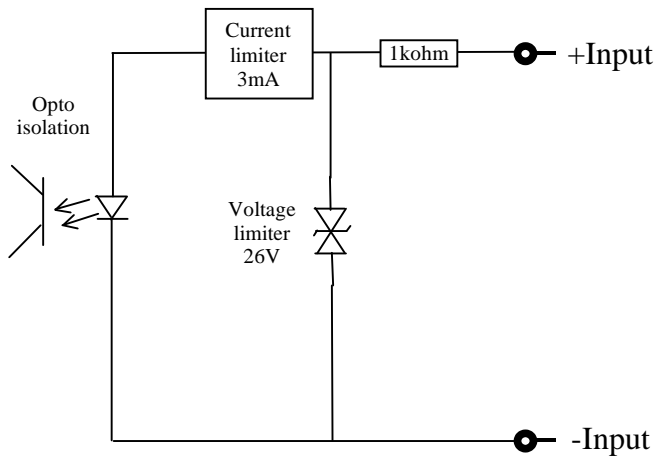
3- wire diagram



Channel nr at CA3460-Card		25 pins DSUB-Connector PIN-connection (PIN 1 = GND)					
Plug-on 1...3	Plug-on 4...6	+Vexc	-Vexc	+Sense	-Sense	+Signal	-Signal
1	4	13	25	12	24	11	23
2	5	9	21	8	20	7	19
3	6	5	17	4	16	3	15

4.2 CD3733 board

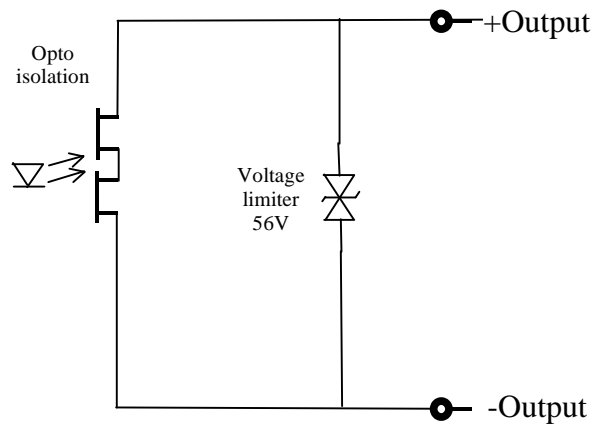
4.2.1 Digital Inputs



Pins on connector CONN1

Channel nr at CD3733-Card	37 DSUB-Connector PIN-connection		Channel nr at CD3733-Card	37 DSUB-Connector PIN-connection	
Channel	+Input	- Input	Channel	+ Input	- Input I
1	19	37	9	11	29
2	18	36	10	10	28
3	17	35	11	9	27
4	16	34	12	8	26
5	15	33	13	7	25
6	14	32	14	6	24
7	13	31	15	5	23
8	12	30	16	4	22

4.2.2 Solid State outputs

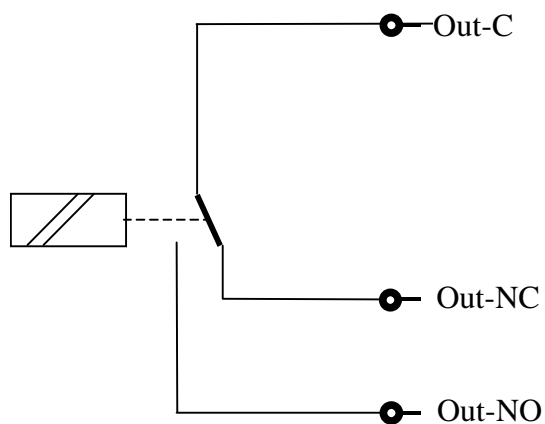


Pins on connector CONN2

Channel nr at CD3733-Card	37 DSUB-Connector PIN-connection	
Channel	+Output	-Output
1	1	20
2	2	21
3	3	22
4	4	23
5	5	24
6	6	25
7	7	26
8	8	27

Channel nr at CD3733-Card	37 DSUB-Connector PIN-connection	
Channel	+Output	-Output
9	9	28
10	10	29
11	11	30
12	12	31

4.2.3 Relay contact outputs



Pins on connector CONN2

Channel nr at CD3733-Card	37 DSUB-Connector PIN-connection
Channel	pin
1-NC	13
1-NO	32
1-C	14
2-NC	33
2-NO	15
2-C	34

5 Connection utilities

5.1 Terminal block PP25DST

For the CA3460 card a special terminal connection block is available.

With the use of this terminal block, wires can easily be connected to the D25 connector, with the use of screw terminals.



Signal connections:

Terminal block	D25 connector	signal	signal	D25 connector	Terminal block
13	13	1-Vexc+	1-Vexc-	25	25
12	12	1-Sense +	1-Sense-	24	24
11	11	1-IN+	1-IN-	23	23
10	10	1-SI+	1-SI-	22	
					22
9	9	2-Vexc+	2-Vexc-	21	21
8	8	2-Sense +	2-Sense-	20	20
7	7	2-IN+	2-IN-	19	19
6	6	2-SI+	2-SI-	18	
					18
5	5	3-Vexc+	3-Vexc-	17	17
4	4	3-Sense +	3-Sense-	16	16
3	3	3-IN+	3-IN-	15	15
2	2	3-SI+	3-SI-	14	14
1	1	Ground	Housing		26

Vexc: Excitation supply.

Sense: Differential sense lines, for measurement of the excitation voltage on the sensor.

IN: Voltage or Current measurement lines. Between these lines the actual measurement is performed

SI: Sensor Identification lines. With these lines the sensor electronic datasheet can be read.

If this Terminal block is used on the second D25 connector of the CA3460, then the channel numbering is 4, 5 and 6 instead of 1, 2 and 3.

Pin 26 of the terminal block is connected to the housing of the system. This pin can be used to connect the screen of the connection cable.

The terminal blocks must be ordered separately.

5.2 Terminal block PP37DST

For the CM3410 card a special terminal connection block is available.

With the use of this terminal block, wires can easily be connected to the D37 connector, with the use of screw terminals.



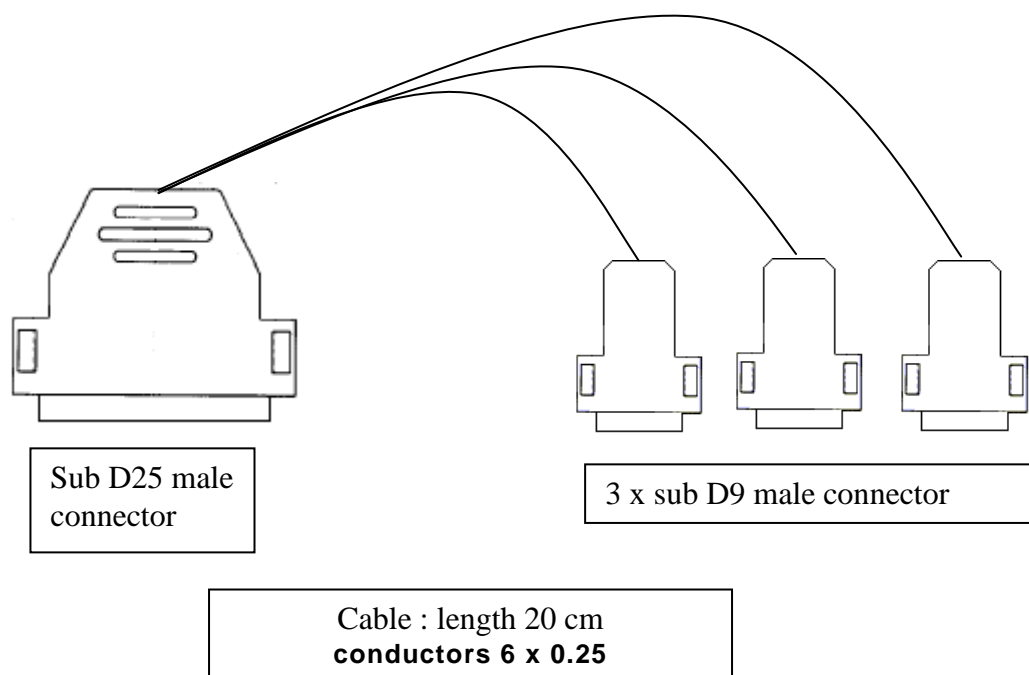
Pin numbering of the PP37DST is the same as on the 37DSUB connector on the board.

Pin 38 of the terminal block is connected to the housing of the system. This pin can be used to connect the screen of the connection cable.

The terminal blocks must be ordered separately.

5.3 Cable SubD25 to 3 x SubD9

For a simple connection to sensors with a SubD9 connector this cable can be used.



SubD25 male on CA3460	SubD9 – male on cable	Signal name
Channel 1		
25	(Yellow) 1	Excitation -
13	(Green) 2	Excitation +
11	(White) 3	Input +
23	(Bourn) 4	Input -
24	(Pink) 6	Sense-
12	(Gray) 7	Sense+
Channel 2		
21	(Yellow) 1	Excitation -
9	(Green) 2	Excitation +
7	(White) 3	Input +
19	(Bourn) 4	Input -
20	(Pink) 6	Sense-
8	(Gray) 7	Sense+
Channel 3		
17	(Yellow) 1	Excitation -
5	(Green) 2	Excitation +
3	(White) 3	Input +
15	(Bourn) 4	Input -
16	(Pink) 6	Sense-
4	(Gray) 7	Sense+

5.4 CJC11 connection box

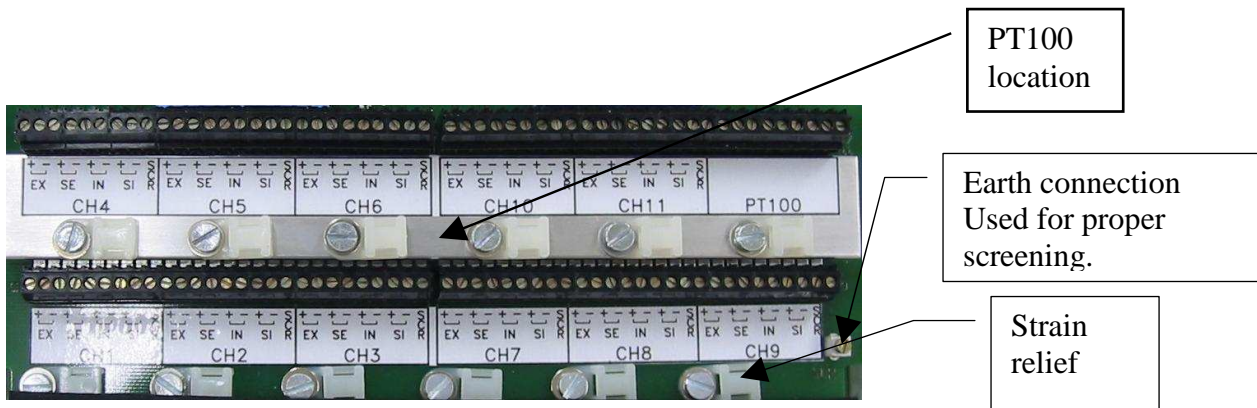
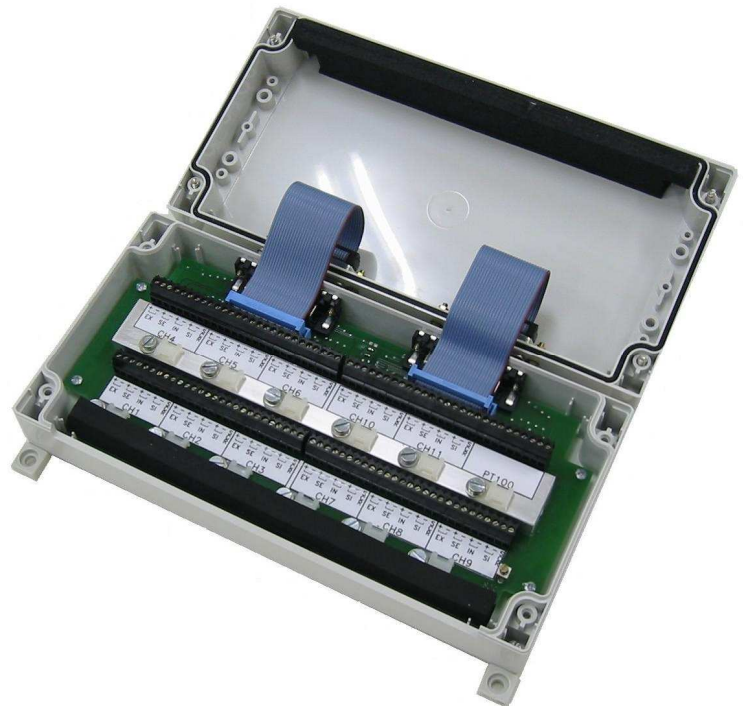
When measuring thermocouples the cold junction temperature must be accurately measured as well. The cold junction temperature is the temperature at the connection terminals, where the transition from copper to the thermocouple wire material causes further thermoelectric voltages which must be compensated through firmware-calculations (CJC – Cold Junction Compensation). For this goal Peekel Instruments has developed the CJC-11 connection box.

What makes this connection box special is the massive aluminium block, placed between two rows of screw terminals. Additional measures ensure that there is a good thermal conduction between aluminium block and screw terminals. The size of the block helps to reduce the speed at which external temperature influences cause the temperature of the cold junction to change.

For accurate measurement of the temperature of the screw terminals a class A Pt-100 sensor is mounted in the middle of the aluminium block. This sensor is connected internally on CH12.

The thermocouple wires are led into the box through a gap in the side of the housing. To protect the inside of the box from air circulation the gap is closed off using a neoprene foam band.

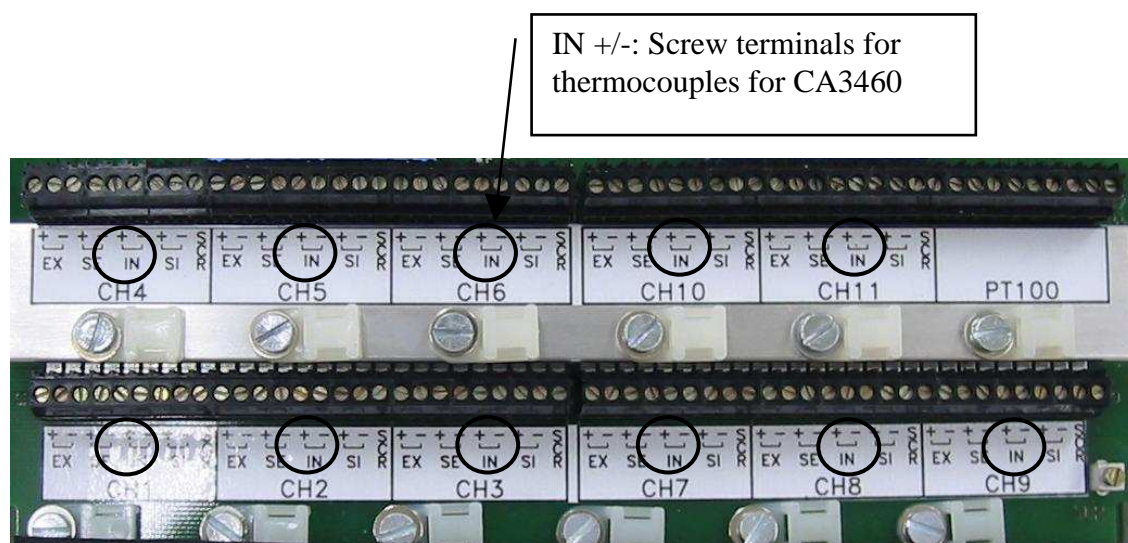
On the other side of the housing are four 25-pin D-Sub connectors. Using appropriate connection cables the CJC-11 can be connected either to two CA3460 measurement cards (for a total of 11 thermocouples and 1 CJC) or to a single multiplexer card CM3410 (for a total of 34 thermocouples and 1 CJC).



5.4.1 CJC-11 in combination with CA3460

4 standard cables are delivered with the CJC11 box, for the connection to two CA3460 cards. Using this configuration, a total of 11 thermocouples can be measured, with 1 CJC.

The connection to the thermocouples uses the screw terminals labelled IN+ and IN-. It is important to note which thermocouple wire is '+' and which is '-'. For CA3460 with thermocouples, the other screw terminals are not relevant.



5.4.2 CJC-11 in combination with CM3410

The CJC-11 has four 25-pin D-Sub connectors. The connection cables delivered with the box can be used to connect these with the two connectors on the CM3410 measurement card (please note the labels on the connectors). With this setup, a total of 34 thermocouples can be measured, using a single CJC.

When using a CM3410 (unlike the CA3460 above), all screw terminals in the CJC-11 box are used. The tables below show which screw terminal are assigned to which channel numbers on the card.

1. Connection cable between CJC D-Sub 1..3 + D-Sub 7..9 and CONN1 (CM3410)

CM3410 group/ch	CJC11 ID	37-DSUB CONN1	25 DSUB 1-3	25 DSUB 7-9	CM3410 group/ch	CJC11 ID	37-DSUB CONN1	25 DSUB 1-3	25 DSUB 7-9
1-1	CH2-EX	19 37	9 21		1-10	CH7-SE	10 28		12 24
1-2	CH2-SE	18 36	8 20		1-11	CH7-IN	9 27		11 23
1-3	CH2-IN	17 35	7 19		1-12	CH7-SI	8 26		10 22
1-4	CH2-SI	16 34	6 18		2-1	CH8-EX	7 25		9 21
1-5	CH3-EX	15 33	5 17		2-2	CH8-SE	6 24		8 20
1-6	CH3-SE	14 31	4 16		2-3	CH8-IN	5 23		7 19
1-7	CH3-IN	13 31	3 15		2-4	CH8-SI	4 22		6 18
1-8	CH3-SI	12 30	2 14		2-5	CH9-EX	3 21		5 17
1-9	CH7-EX	11 29		13 25	2-6	CH9-IN	2 20		3 15

1. Connection cable between CJC D-Sub 4..6 + D-Sub 10..12 and CONN2 (CM3410)

CM3410 group/ch	CJC11 ID	37-DSUB CONN2	25 DSUB 4-6	25 DSUB 10-12	CM3410 group/ch	CJC11 ID	37-DSUB CONN2	25 DSUB 4-6	25 DSUB 10-12
2-7	CH5-EX	19 37	9 21		3-4	CH10-SE	10 28		12 24
2-8	CH5-SE	18 36	8 20		3-5	CH10-IN	9 27		11 23
2-9	CH5-IN	17 35	7 19		3-6	CH10-SI	8 26		10 22
2-10	CH5-SI	16 34	6 18		3-7	CH11-EX	7 25		9 21
2-11	CH6-EX	15 33	5 17		3-8	CH11-SE	6 24		8 20
2-12	CH6-SE	14 31	4 16		3-9	CH11-IN	5 23		7 19
3-1	CH6-IN	13 31	3 15		3-10	CH11-SI	4 22		6 18
3-2	CH6-SI	12 30	2 14		3-11	PT100	3 21		5 17
3-3	CH10-EX	11 29		13 25			2 20		3 15

6 Active X controls

6.1 CA3460 Active X Control

Using the CA3460Net control you can configure and control a collection of CA3460 cards connected to a communication interface. The network and its devices can be configured using the following three property pages:

- Network Configuration: Configure communication interface and scan for available cards.
- Cards Configuration: Configure the individual channels of each card to set the type of measurement and measurement interval.
- Channels Configuration: Configure the individual channels of each card to set the type of measurement and measurement interval.
- Trips Configuration: Configure up to four trips for each individual channel of each card.

6.1.1 CA3460 properties

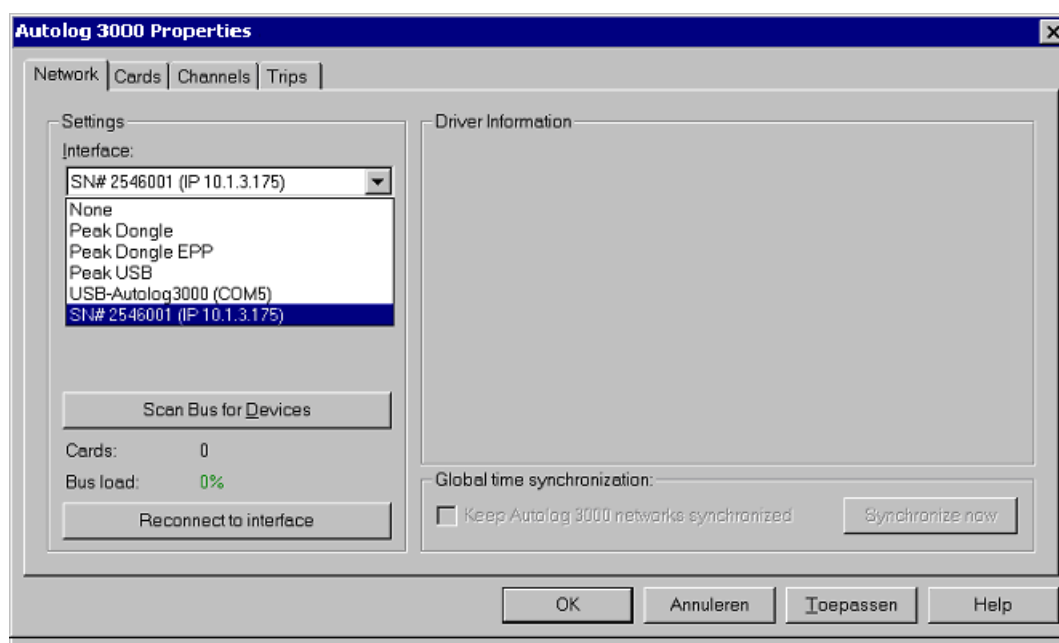
The settings for CA3460 modules can be shown and modified using a series of property pages, which are described below.

6.1.2 Network Configuration Page

Use this dialog to configure the communication network. Select the communication interface and parameters and set the correct speed, then press 'Scan Bus for Devices' to detect which devices are connected to the communication bus.

After detecting the devices, proceed to the Channels Configuration Page to configure the individual channels.

The first page will show the interfaces which are available to communicate with one or more Autolog 3000 systems. If more than 1 system must be connected to the controlling software (Autosoft, Signasoft or an other package), for each of them the next actions must be preformed.

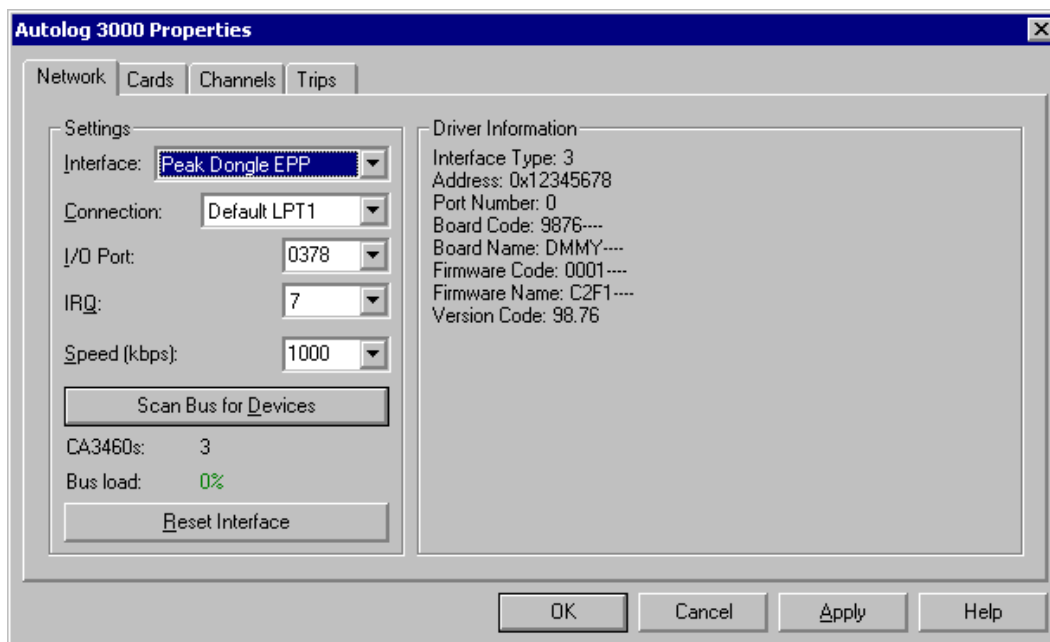


First select the interface on which the device is connected that you want to add to the software configuration.

The interface which are selectable are:

1. none.
No interface selected
2. Peak Dongle
This is a dongle placed on the printer port, for communicating with the CAN bus
3. Peak Dongle EPP
Same as previous , only now the EPP facilities are used on the printer port
4. USB-Autolog 3000 (COM5)
This is a direct USB connection to a Autolog system. If more Autolog 3000 systems are connected to the PC with several USB ports, for each of those systems a separate interface will be in this list. The comm port number in those interface names will be different. This port number is assigned to the Autolog 3000 system during installation.
5. SN #2546001 (IP 10.1.3.175)
This is a direct connection through the Ethernet network. The serial number in the interface name belongs to the PB3000 in the Autolog 3000 system.
If more Autolog 3000 systems are connected to the network, for each of those systems a separate interface will be in this list.

When an interface is selected, extra settings can be made for this specific interface.



When a printer port is selected the next settings must be made:

The individual items in this configuration page described:

Connection: For the parallel port CAN dongle, select the parallel port to use. If your parallel port uses special IRQ or I/O settings, enter them manually.

I/O Port: Only change this value if your parallel port uses a special I/O port. You can select the I/O address from the list or type your own value.

IRQ: Only change this value if your parallel port uses a special IRQ (Interrupt ReQuest). Select the appropriate value from the list.

Speed (kbps): Select the communication speed to use on the CAN bus network. When this speed is changed it can take some seconds before the Autolog 3000 systems has adapted to this speed. If the selected speed is to fast, no connected can be made to the Autolog 3000 systems, because due to the errors on the bus, the data from the Autolog 3000 systems will not be received by the PC.

The maximum speed of the CAN network depends on the total cable length.

CAN Busconfiguration		Max. number of channels at several measurement speeds			
Speed	Total cablelength	1000 Hz	100 Hz	10 Hz	1 Hz
1 Mbit /s	<30 m	7	70	192	192
800 kbit/s	<50 m	5	56	192	192
500 kbit /s	<100 m	3	35	192	192
250 kbit /s	<250 m	2	17	175	192
125 kbit /s	<500 m	1	8	87	192
50 kbit /s	<1000 m	-	3	35	192
20 kbit /s	<2500 m	-	1	14	140

Can bus speed versus Cable length.

The actual maximum cable length at a specific CAN bus speed may be shorter then mentioned in this table due to cable capacity and used stub lines or other connection hardware. Be very careful if the length mentioned in this table must be used.

This speed must also be entered when the “**PEAK USB**” interface is selected.

When a interface is selected and the requested parameters are entered, a “**Scan Bus for Devices**” command must be given. Now the interface will be checked for the systems connected to this interface. If the interface is usable by the software the “**Driver Information:**” box will show the driver specific information from the communication interface hardware driver.

Just behind the text “**Cards:**” the number of cards found in the Autolog 3000 system will be displayed.

If for some reason no connection can be made to the interface the “**Reconnect to interface:**” command can be given. The connection to interface will be closed and established again.

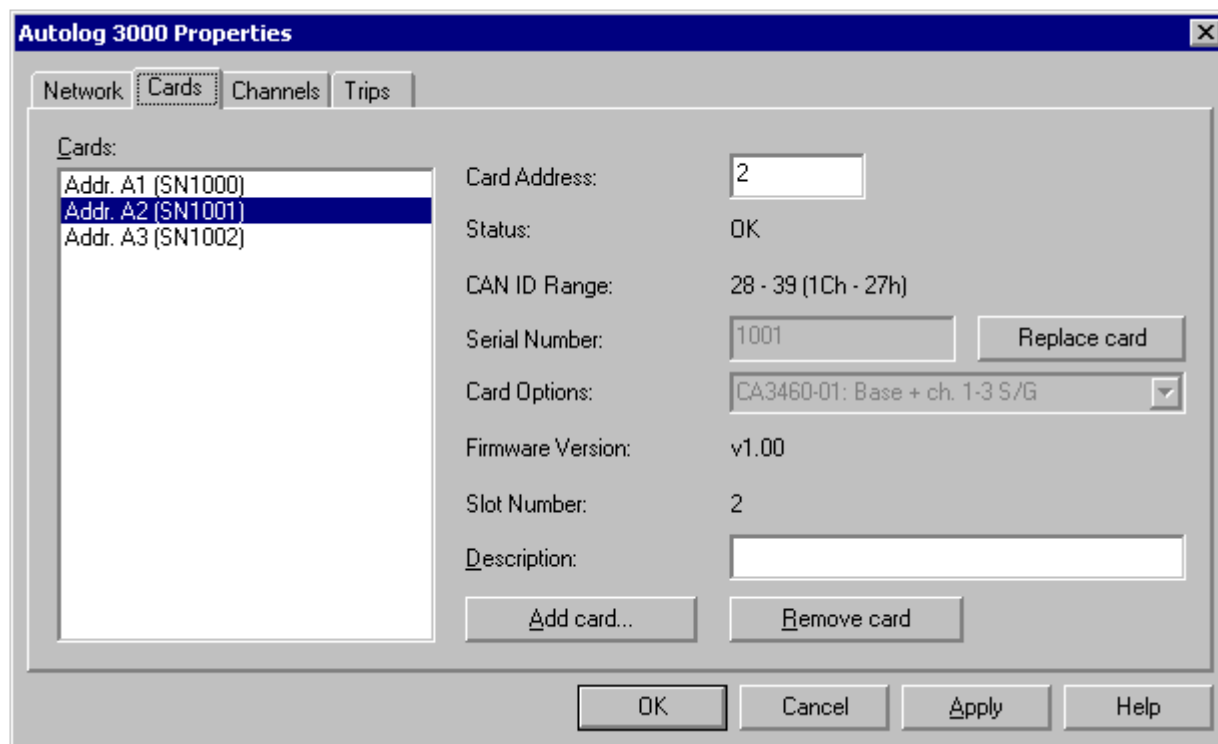
The “**Bus load:**” shows the amount of communication as a percentage of the available bandwidth on the communication interface between PC and device. This is just an indication. It is not an accurate number

Global time synchronization

This item is selectable when more then 1 Autolog 3000 system is connected to the PC. When selected the software will try to synchronize the incoming data. For this reason the “**Synchronize now**” command must be given once. After this command the time stamps belonging to the data will be identical for the separate Autolog systems. Important is that the cable connection for the synchronization is present. If not all the Autolog 3000 system will run on there local clock. Because these clock are derived from the CPU clock they will not be exactly the same. With the external synchronization cable connected all the systems will run on the same clock generated by one of the connected systems.

The second problem with time synchronization is the deviance between the Autolog 3000 clock(s) and the PC date/time. These two will also be unequal. The software will try to adapt the time stamp belonging to the measured values to be synchronized with the PC date/time clock. To have an absolute reference to time, be sure that the PC clock is running correct. (this can be established by using the DCF77 date/time signal).

6.1.3 Cards Configuration Page



Use this dialog to configure the individual cards. You can select the card to configure from the list on the left side. If this list does not show any cards, go to the Network Configuration Page to configure the communication network and press the 'Scan Bus for Devices' button.

The configuration items on the right side of the dialog show the settings for the currently selected card.

The individual items in this configuration page described:

Cards: Select a card from this list to show its information.

Card Address: Shows the logical card address of the card. This address determines the CAN ID range that the card uses for communication. If you change this value, the card will be reprogrammed to communicate using the new address.

Status: Shows the communication status of the card. The status is OK if all channels on the card respond as expected, DISCONNECTED if the card fails to produce measurement values for one or more channels on the card.

CAN ID Range: Shows the CAN ID range that the card uses for communication.

Serial number: Shows the serial number of the selected card.

Replace card: Allows you to replace a card at a specific address by another one (with a different serial number). The exact procedure depends on the type of interface used to communicate with the PC.

CAN interface

When a CAN interface is used, all cards are assigned a unique CAN address. When you replace a card, the new card will get a new unique CAN address and needs to be specifically configured to act as a replacement for the old card. Follow these steps to make the replacement:

Close your application and make a backup of the configuration/settings file, where applicable.

Note the serial number of the replacement card, you will need it later.

Switch off the device, and replace the card.

Switch the device back on and load your software-configuration. Now go to the cards configuration dialog, and select the card that you replaced.

Manually type in the serial number of the replacement card, then press the 'Replace Card' button. The software should now transfer the settings of the old card to the new one.

USB or Ethernet interface

For these interfaces, cards are identified by the slot number they are placed in. This makes replacing a card easier than using the CAN interface. Follow these steps to make the replacement:

Close your application and make a backup of the configuration/settings file, where applicable.

Switch off the device, and replace the card.

Switch the device back on and load your software-configuration. Now go to the cards configuration dialog, and select the card that you replaced.

Press the 'Replace Card' button. The software should the new card in the slot and transfer the settings of the old card to the new one.

Card options: Shows the type of card and its option modules.

Firmware version: Shows the firmware version of the card.

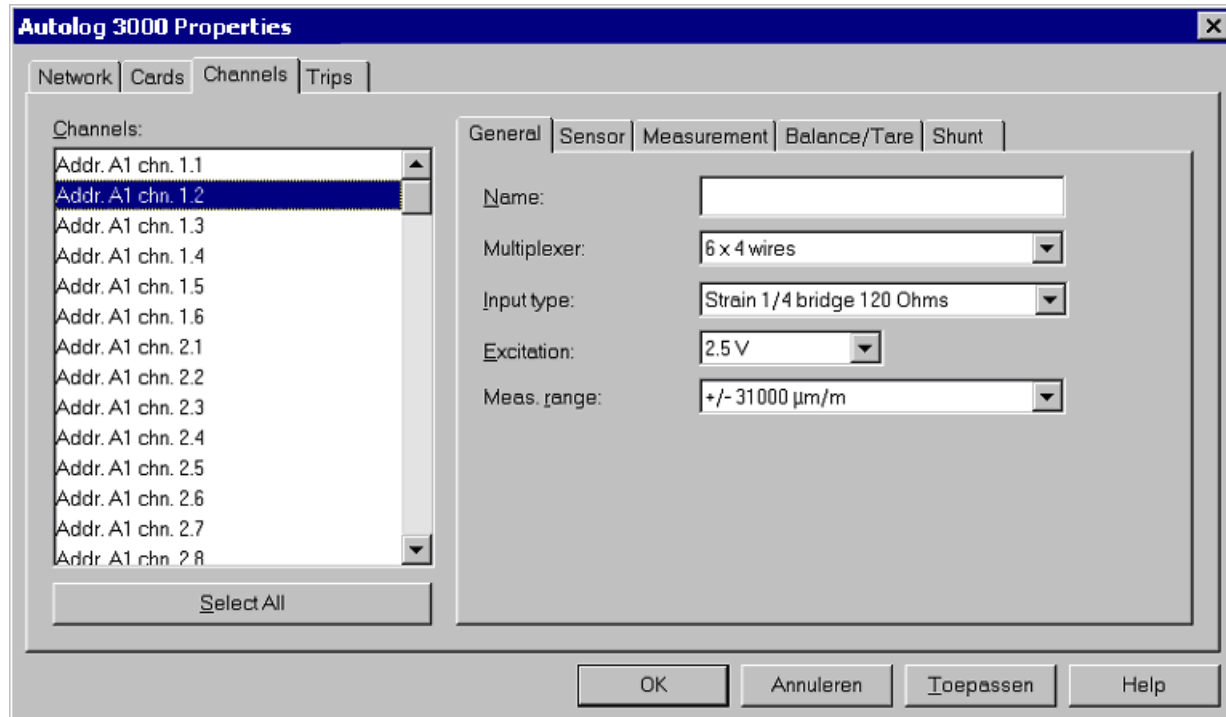
Slot number: Shows which slot number in the Autolog 3000 the card occupies.

Description: Use this description to make the card easier to identify.

Add card: Use this button to manually add a new card to the configuration. You must know and specify the serial number of the card to be able to use this function.

Remove card: Use this button to remove a specific card and all its settings from the current configuration.

6.1.4 Channels Configuration Page



Use this dialog to configure the individual channels. You can select one or more channels to configure from the list on the left side. If this list does not show any channels, go to the Network Configuration Page to configure the communication network and press the 'Scan Bus for Devices' button.

To select ranges of channels, click on the first channel, then press and hold the SHIFT key and click on the last channel. To select multiple individual channels, press and hold the CTRL key and click on the channels.

The configuration items on the right side of the dialog show the settings for the currently selected channel(s). When multiple channels are selected and an item is blank, it means that the channels have different settings for this item. When you select a new value for the item, it will apply to all selected channels.

The individual items in this configuration page described:

Channels: Using the SHIFT and CTRL keys in combination with the left mouse button, you can select one or more channels from this list to configure.

Select All: Press this button to select all available channels.

Name: Sets the name of the selected channel(s). If the same name is assigned to multiple channels, the channel names will automatically be made unique by appending a number. You can use the name to make the channels easier to identify.

Input type: Sets the type of measurement performed by the selected channel(s).

Excitation: Sets the excitation voltage as supplied to the sensor. The list of available excitation voltages depends on the type of card and its options. When measuring a 120 Ohms strain gauge using a CA3460 with option 1, beware not to set the excitation voltage higher than 2.5 V.

Meas.range: Sets the range to be used by the selected channel(s). Which ranges are available depends on the type of measurement.

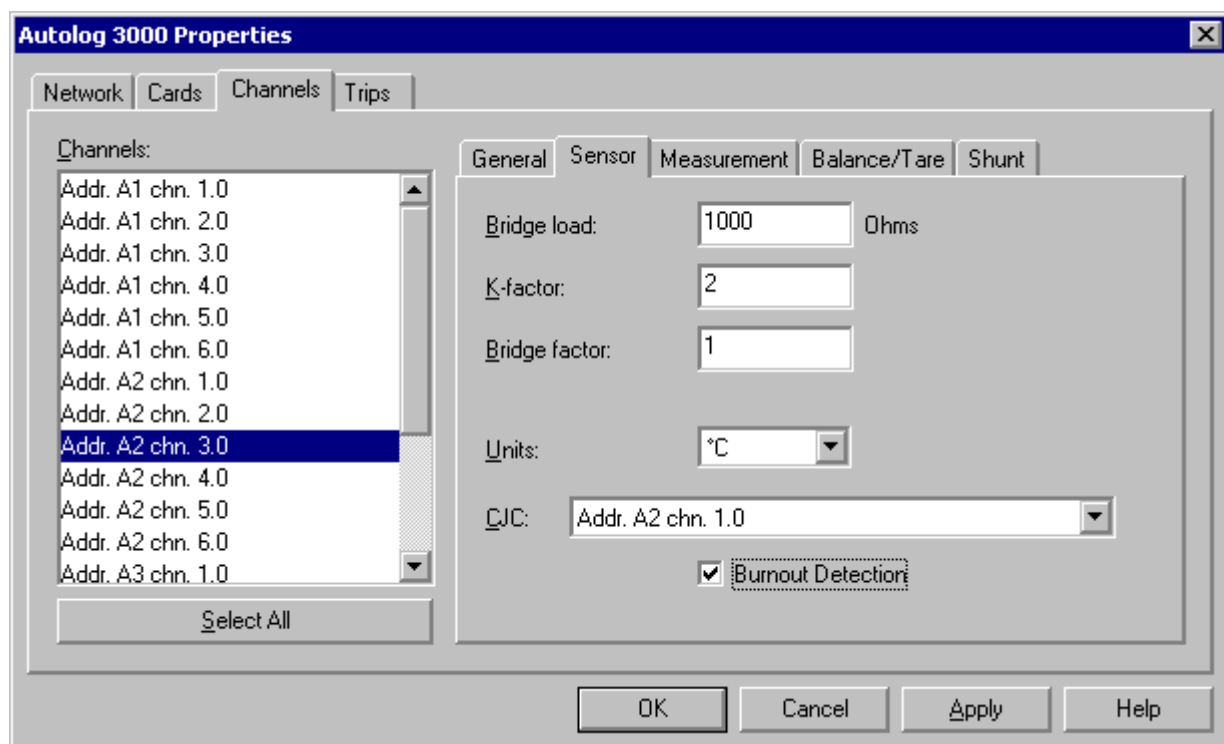
Note for S/G: the range can only be accurately calculated when the gage factor and the bridge factor on the next tab are set correctly. Please check the range setting again after making changes to those factors.

The “**Multiplexer**” setting is only available when a channel is selected which is on the CM3410 multiplexer card. The channels on this card are divided into 3 groups. For each group a selection must be made for the multiplexer. This multiplexer can handle the next type of sensor connections:

- 2 wire connection, e.g. for simple DC voltage signals
- 4 wire connection, e.g. for a potentiometer or a quarter bridge sensor
- 6 wire connection, e.g. for a full bridge sensor with sense lines on the excitation
- 8 wire connection, e.g. for the same full bridge sensors with sense lines and TEDS connection
- 10 x TC + 1 CJC, used for thermocouple measurements where 10 thermocouple channels can be connected in 2-wire configuration, together with a 4-wire CJC channel.

In the “**Input type**” box, only those sensors type are noted which can be measured with the selected multiplexer setting.

6.1.5 Channels Configuration: Sensor



The sensor tab page of the channel configuration contains parameters specific to strain gage, pt-100 and thermocouple measurements. Which parameters are shown depends on the type of input selected on the general tab.

Settings for strain gage and transducer measurements

Bridge load: For strain gage and transducer measurements, the sensor impedance. This value is used to determine the expected shunt measurement values. This value has no influence on normal measurements.

K-factor: For strain gage measurements, the gage factor of the strain gage element, depending on material type. The correct value can be found on the packaging of the strain gage, and is usually around 2.

Bridge factor: For strain gage measurements, the bridge factor for half and full-bridge measurements. The value indicates how many of the strain gages actively contribute to the signal. A typical example of a half-bridge S/G configuration, where the bridge factor is not equal to 2, is the use of a second S/G solely for temperature compensation. This second strain gage is usually affixed to the same material and placed near the location of the active strain gage. This so-called dummy S/G experiences the same elongation due to temperature as the active S/G (which cancels out the influence on the measured value), but no mechanical load. In this example the bridge factor would be 1.

Another example is a full-bridge S/G, where 2 S/G's are active and the other 2 are affixed at a 90° angle to the direction of the load. In this case a typical bridge factor would be 2.6. Other examples can be found in the literature on strain gage measurements.

Settings for thermocouple and Pt-100

Note: for thermocouples it is practical to configure the CJC-channel (Pt-100) first, otherwise it will not appear in the list of available CJC points.

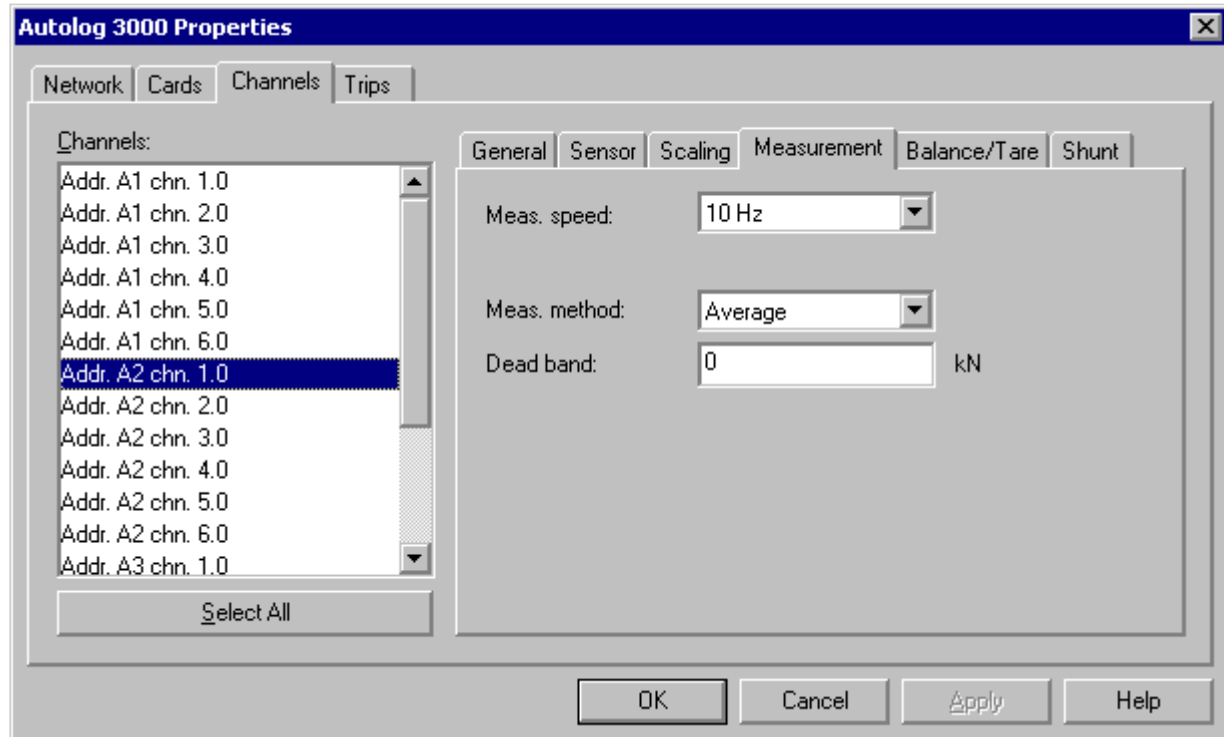
Units: Selects the presentation units for temperature measurements (Celsius, Fahrenheit or Kelvin).

CJC: For thermocouples, selects the (Pt-100) input to use for cold-junction-compensation measurement. When measuring thermocouples, the transition between the thermocouple wires and connection box (cold junction) causes thermoelectric voltages which induce a temperature-dependent error in the measurement. Therefore, this temperature must be measured in order for the firmware to compensate for this error. As a rule a Pt-100 element is used to accurately determine the temperature at the connection point. Peekel Instruments has a special CJC-11 connection box for this purpose.

Burnout detection: For thermocouples, burnout detection makes sure that a broken wire on a thermocouple measurement does not go undetected. Using this option, a broken thermocouple causes a fixed value to be shown, indicating an error. Without this, an open input can lead to an unpredictable value, which may not always clearly be recognized as an error.

Beware: for thermocouples with very high impedance (e.g. by using very long/thin cables) or IR-temperature sensors the burnout detection should be switched off, as it can lead to an inaccurate measurement value in this case.

6.1.6 Channels Configuration: Measurement



The measurement tab page of the channel configuration determines the measurement speed and related parameters.

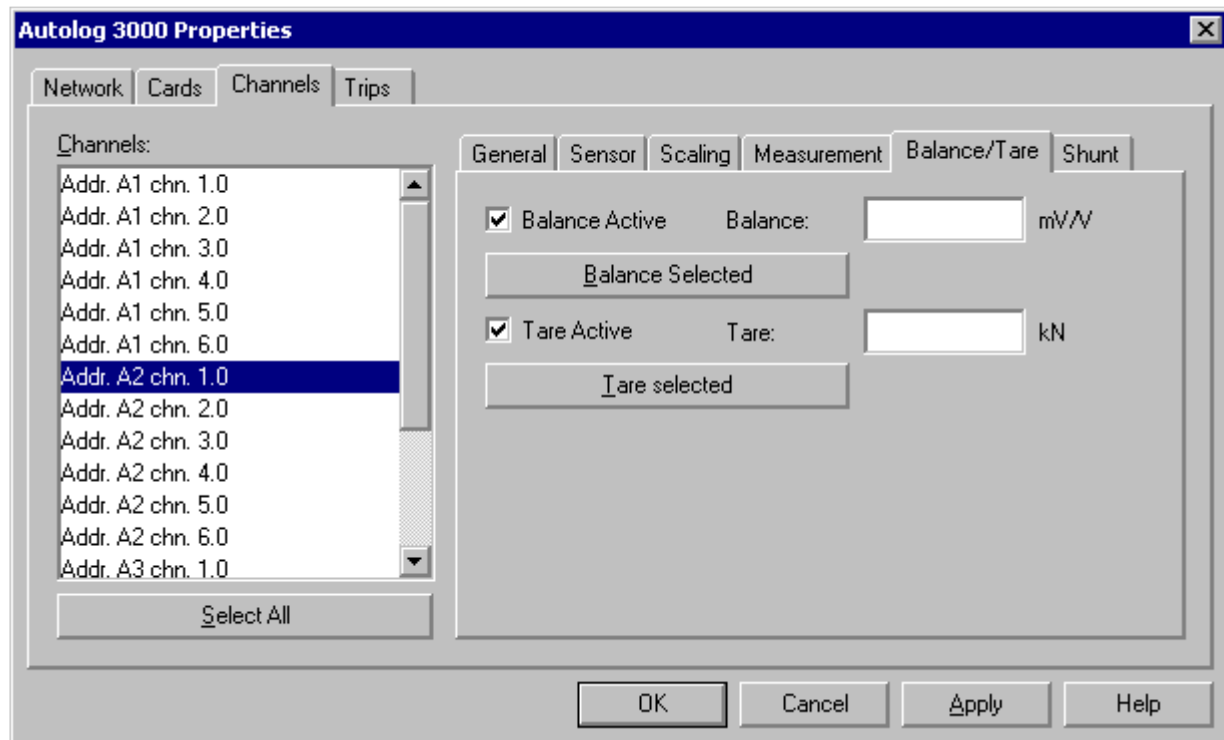
Meas. speed: The speed at which the channel should output measurement values.

Scan speed: The speed at which the card measures internally. If set to 'Auto', the optimum speed will be determined automatically. The rule is that the Scan speed is 100 Hz for measurement speeds of 100 Hz and lower or 5 Hz for measurement speeds of 5 Hz and lower. This setting is most important when using Meas. method 'Maximum' or 'Minimum'!

Meas. method: For measurement speeds lower than 1000 Hz, this setting determines what operation the hardware should perform on the raw measurement values (@ 1000 Hz) to reduce it to the requested amount of data.

Dead band: If set to 0 (default), all measured values will be output at the requested speed. Otherwise, measured values will only be output if they differ from the last output value by more than the dead band setting. Regardless of the dead band setting, at least one measurement value will be output every second.

6.1.7 Channels Configuration: Balance/Tare



The balance/tare tab page of the channel configuration contains settings and commands for balance and tare functions.

Difference between balance and tare:

Balance: the measurement value is set to 0 before conversion to physical units.

Tare: the measurement value is set to 0 after conversion to physical units.

If a scaling is used that introduces an offset, then performing a balance will not set the measured value to zero (in physical units), but to the offset.

Balance active: Determines whether or not the balance value is used for this channel.

Balance selected: Performs a balance command on the current selection of channels. This command averages the measured values over a period of 1 second to determine a stable balance value.

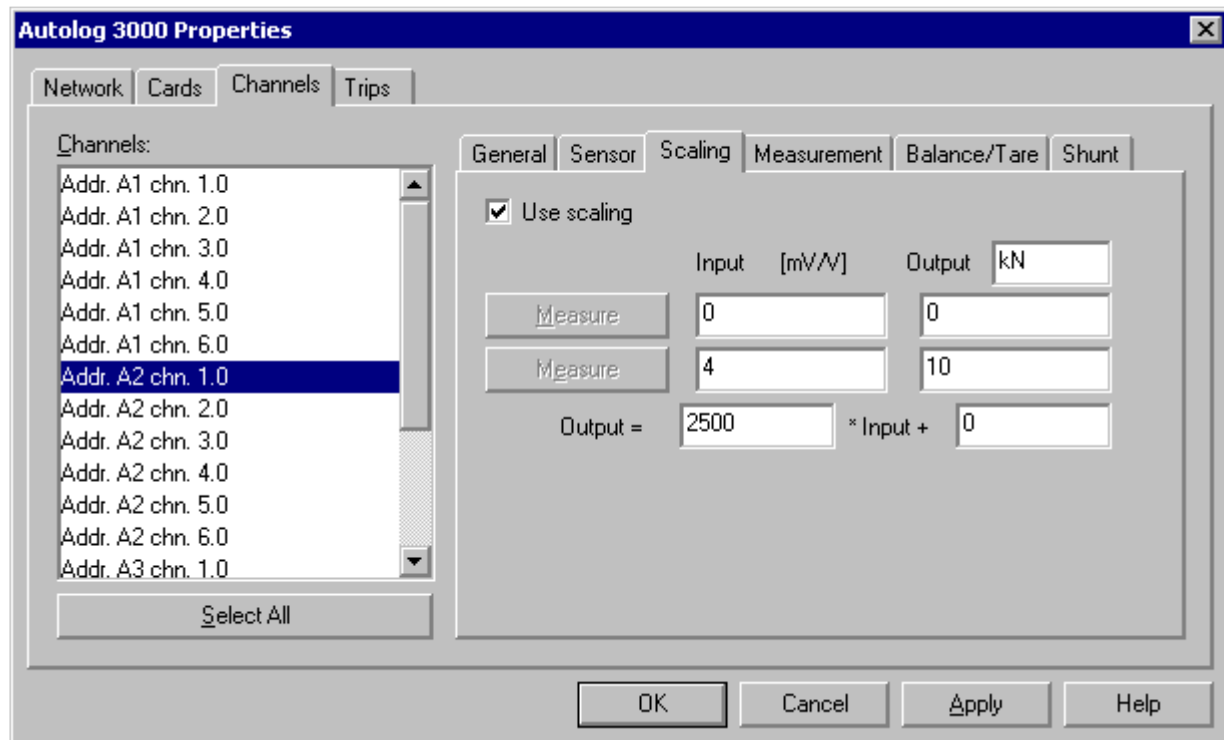
Balance value: The current balance value. It is possible to manually modify this value.

Tare active: Determines whether or not the tare value is used for this channel.

Tare selected: Performs a tare command on the current selection of channels. This command averages the measured values over a period of 1 second to determine a stable tare value.

Tare value: The current tare value. It is possible to manually modify this value.

6.1.8 Channels Configuration: Scaling



The scaling tab page of the channel configuration contains scaling parameters to allow for a linear scaling from the input value to suitable engineering units.

Use scaling: Determines whether or not linear scaling is used.

Output units: Freely assignable engineering units in which the result of the linear scaling is expressed.

Measure: Press this button to obtain the latest measurement value for this channel as input value. You should first activate the channel and set a suitable measurement speed (slow to get a stable value) before using this function.

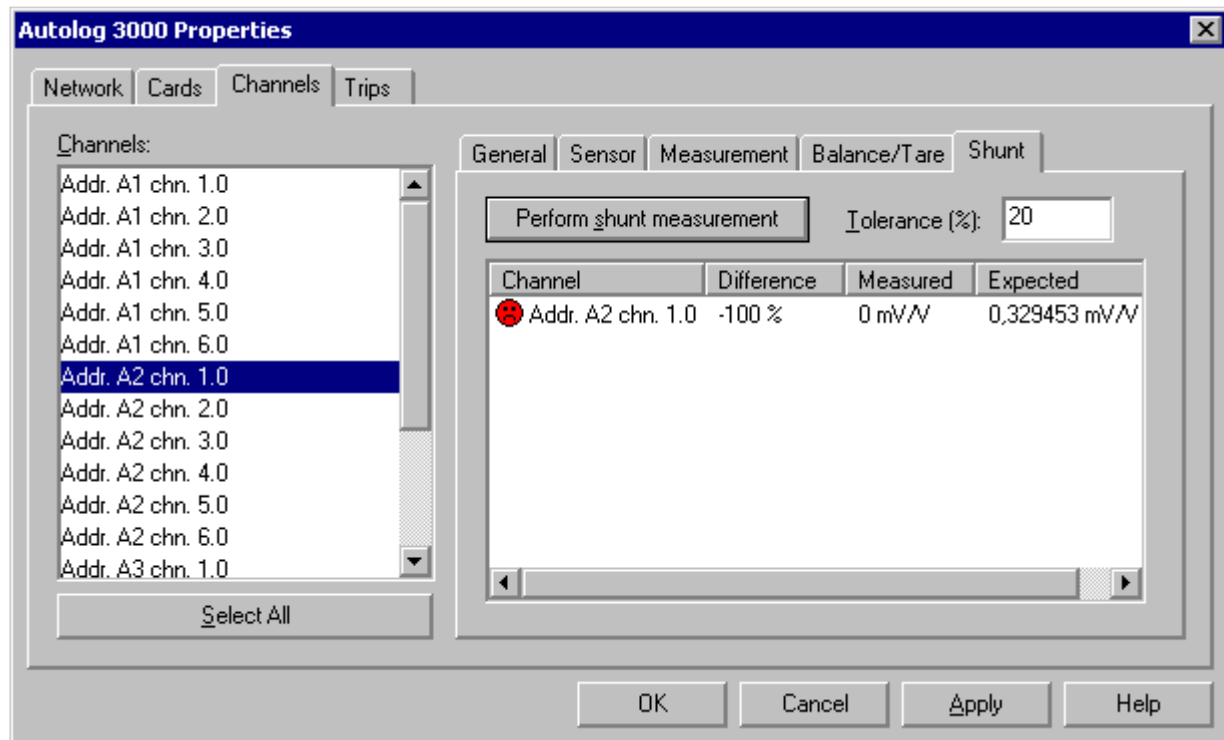
Note: this function is used to measure the range of sensors. To do this, the sensor should be supplied to two different known values and measured at those points. The known values should be entered by hand as output values.

Input values: You can choose two different input values for which you know the physical output value you desire.

Output values: When you change on of the output values, the new factors for scaling will be calculated and shown.

Scaling formula: The formula shows how the input values are converted to the output values. You can modify this formula to your liking.

6.1.9 Channels Configuration: Shunt



The shunt tab page of the channel configuration allows you to perform shunt measurements **for strain gage and transducer** channels on a CA3460 with option 1.

Perform shunt measurement: Press this button to perform a shunt measurement on the selected channels. A shunt measurement will only be performed for channels configured to a suitable input type (strain gage, transducer).

Shunt tolerance: Determines the maximum difference allowed between the expected and the measured value. If the difference is greater, a red smiley is shown in the measurement results.

Results: The results of a shunt measurement are shown in a list which includes the measured value in mV/V, the expected value and the difference in percent for each measured channel.

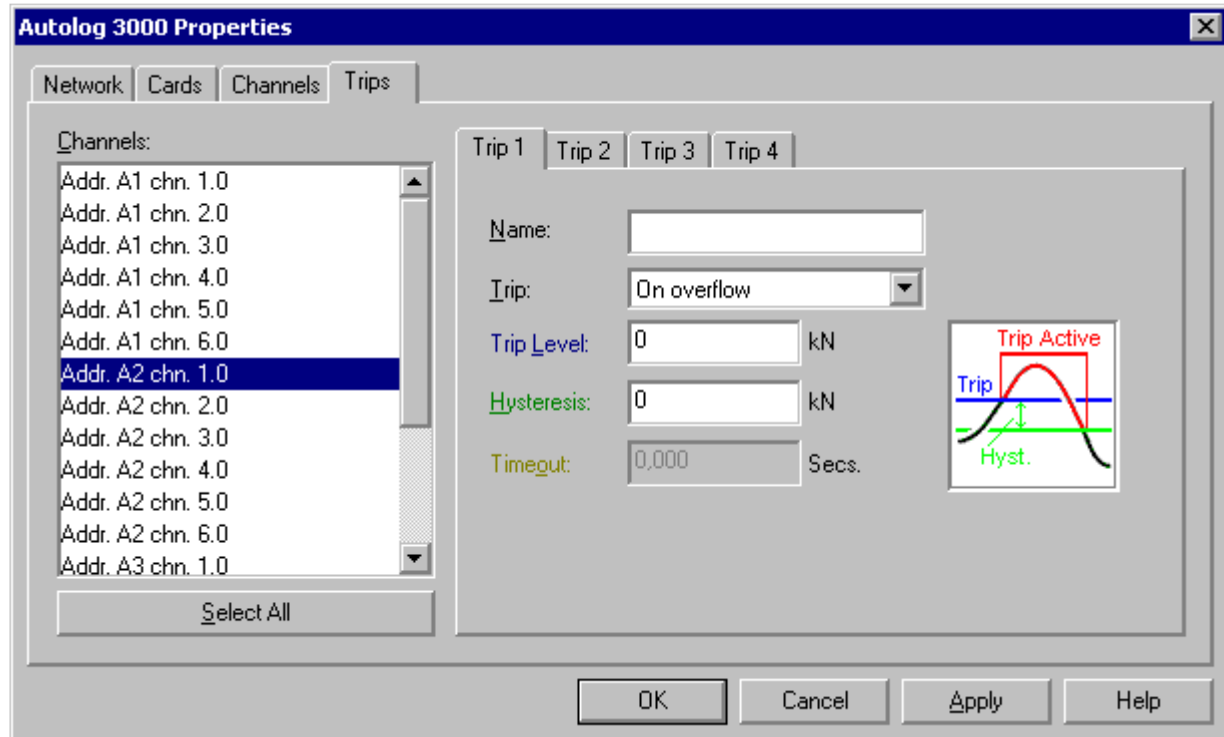
Judging the results, or, what do the red smilies mean?

Question: how high is the actual difference? Possibly the default tolerance of 20% is not enough, e.g. when very long measurement cables are used.

If the measured difference is very big, these are the things to look out for:

- Is the sensor connection correct (correct channel, correct wiring)?
- Is the configured sensor type (tab General) correct? For ¼ bridge S/G: check the resistance value!
- Is the correct bridge load entered in the tab Sensor?
- Is the measurement cabling (connection to the sensor) OK?

6.1.10 Trips Configuration Page



Use this dialog to configure up to four trips for the individual channels. You can select one or more channels to configure from the list on the left side. If this list does not show any channels, go to the Network Configuration Page to configure the communication network and press the 'Scan Bus for Devices' button.

To select ranges of channels, click on the first channel, then press and hold the SHIFT key and click on the last channel. To select multiple individual channels, press and hold the CTRL key and click on the channels.

The configuration items on the right side of the dialog show the settings for the currently selected channel(s). When multiple channels are selected and an item is blank, it means that the channels have different settings for this item. When you select a new value for the item, it will apply to all selected channels.

The individual items in this configuration page described:

Channels: Using the SHIFT and CTRL keys in combination with the left mouse button, you can select one or more channels from this list to configure.

Trips tabs: From this tab strip, you can choose between the four different trips that can be configured per channel.

Name: Set a freely configurable name for the trip.

Trip: Sets the type of trip, unused trips are marked 'disabled'.

'On overflow' trips will activate as soon as the signal exceeds the trip level and deactivate as soon as the signal drops below 'trip level - hysteresis'.

'Retriggerable overflow' trips will activate as soon as the signal exceeds the trip level and deactivate when the signal remains below 'trip level - hysteresis' for at least 'timeout' seconds.

Trip Level: Sets the level at which the trip should activate. The value should be entered in the units displayed to the right of the input box.

Hysteresis: Sets the hysteresis band around the trip level that determines when the trip should deactivate. The value should be entered in the units displayed to the right of the input box. It will be added to or subtracted from the trip level to find the level at which the trip will deactivate.

Timeout: Sets the timeout time in seconds for retriggerable trips.

7 Card communication

The communication with the CA3460 must be done through the CAN bus. For this communication a CAN bus ID is required. The CA3460 ID must be set through the CAN bus communication.

The CAN ID's used on the bus are standard 11 bits long.

Via a special command, the serial number of the CA3460 card together with its CAN ID are sent on the CAN Bus. Every unit will receive this message. The CA3460 card with the corresponding serial number will take over the CAN ID, and answer the message.

Each channel has its own two CAN ID's.

1 CAN ID is used for the actual measurement value.

The other CAN ID is used for other commands, like channel configuration.

The CA3460 card will receive 1 CAN ID during configuration.

This CAN ID will be called Card ID.

channel nr	description	CAN ID
01	meas value	Card ID
	commands	Card ID +1
02	meas value	Card ID +2
	commands	Card ID +3
03	meas value	Card ID +4
	commands	Card ID +5
04	meas value	Card ID +6
	commands	Card ID +7
05	meas value	Card ID +8
	commands	Card ID +9
06	meas value	Card ID +10
	commands	Card ID +11

The first channel is addressed by the Card ID and Card ID+1, and the second channel is addressed by the card ID+2 and Card ID+3, and so on.

7.1 CA3460 DC direct input card

Each type of card has a basic number of channels, each with a number of multiplex count.

Card type	Number of base channels	Numer of multiplex channels for each base channel
CA3460	6	0
CM3410	3	3,4,6 or 12
CD3733	2	16

The number of multiplexer channels on the CM3410 depends on the wire connection selected for the base channel.

The configuration of the CD3733 is a bit different. For clarity this is described in a separate chapter.

Each of the channels must be configured.

Each channel configuration has 4 bytes.

Information sent to the cards is done on a command basis. The first data byte holds the command.

The following commands can be given:

nr	description	
01	Set channel configuration	command content (6 bytes): 1 st byte: 01 (command) 2 nd byte: multiplexer channel nr, 0 for CA3460 3 rd – 6 th byte contain the channel settings response: no response
02	Get channel configuration When this command is sent to CAN ID 0, all the CA3460 cards will send the configuration of each channel	command content (1 byte): 1 st byte: 02 (command) response: 1 message for each configured channel (7 bytes): 1 st byte: 02 (command) 2 nd byte: card type, CA3460 = 0x40, CA3410 = 0x41 3 rd byte: multiplexer channel nr, 0 for CA3460 4 th - 7 th byte: configuration of the channel
03	Get card serial number When this command is sent to CAN ID 0, all the CA3460 cards will respond	command content (8 byte): 1 st byte: 03 (command) response (7 bytes): 1 st byte: 03 (command) 2 nd -5 th byte: card serial number 6 th byte: card slot number (0-14 = slot number in rack, 15 = card not placed in a rack) 7 th byte: card options, defined hex codes: 00h = version 1 base card 11h = version 2 base card 12h = S/G option for channels 1-3 21h = S/G option for channels 4-6 22h = S/G option for all channels 33h = LVDT option for all channels

		Other option combinations are also possible, i.e. 13h LVDT option for channels 1-3 etc. 8 th byte: card type, CA3460 = 0x40, CA3410 = 0x41
04	Set device CAN ID	command content (7 bytes): 1 st byte: 04 (command) 2 nd -5 th byte: CA3460 serial number to set CAN ID for 6 th -7 th byte: CAN ID to assign to the card response: no response
06	Do special measurement	command content (5 bytes): 1 st byte: 06 (command) 2 nd byte: multiplexer channel nr, 0 for CA3460 3 rd byte: 01 = balance measurement 02 = tare measurement 03 = shunt measurement (bridge type only) 07 = read sensor ID 4 th -5 th byte: number of milliseconds for the duration of the required measurement. The requested measurement will be executed. The value will be sent as a measurement value, only the 3 high bits in the channel number will hold the above mentioned code.
07	Get special measurement	command content (3 bytes): 1 st byte: 07 (command) 2 nd byte: multiplexer channel nr, 0 for CA3460 3 rd byte: 01 = balance measurement 02 = tare measurement 03 = shunt measurement 04 = dead band value 05 = low peak value 06 = high peak value 07 = return sensor ID in The requested measurement will not be executed. response (7 bytes): 1 st -3 rd byte: identical to the command sent 4 th -7 th byte: the requested value (floating point)
08	Set special measurement	command content (3 bytes): 1 st byte: 08 (command) 2 nd byte: multiplexer channel nr, 0 for CA3460 3 rd byte: 01 = balance measurement 02 = tare measurement 04 = dead band value 4 th -7 th byte: value of measurement response: no response
09	Set CJC channel	command content (3 bytes): 1 st byte: 09 (command) 2 nd -3 rd byte: CAN id for CJC value 5 MSB holds multiplexer channel number 11 LSB holds the 11 bit CAN ID
10	Peak value measurement	command content (3 bytes): 1 st byte: 10 (command) 2 nd byte: multiplexer channel nr, 0 for CA3460 3 rd byte: 00 = stop peak value measurement

		01 = activate peak value measurement The peak value measurement will be executed on each measured value (1000 time each second). No extra filtering will be done on the signal. When a new min or max value is detected, it will be sent immediately.
19	Perform synchronization	command content (1 byte): 1 st byte: 19 (command) response: no response
20	Get firmware version	command content (1 byte): 1 st byte: 20 (command) response (5 bytes): 1 st byte: 20 (command) 2 nd -5 th byte: firmware version (integer value, i.e. 116 = v1.16)

Note:

The special measurements “Balance, Tare and Shunt” are floating point numbers and in the unit input voltages [V] or [V/V] for bridge measurements.

When a dead band value is sent to the card, the actual measurement will be sent every second. This is a value according to the selected measurement method and measurement speed. When the value has changed more than the dead band value since the last transmitted value, it will be sent immediately.

7.1.1 Communication control

17	Resume communication	command content (1byte): 1 st byte: 17 (command) response: no response
18	Stop communication	command content (1byte): 1 st byte: 18 (command) response: no response

With these commands the sending of the measured values from the USB controller in the Autolog 3000 system is stopped or resumed. This USB controller will send all the measured values from the input cards directly to the PC through the USB connection. This communication will be almost continuously. When the software on the PC wants to stop/start this communication it has to send the appropriated command

7.1.2 Channel configuration bytes.

The first byte

The first configuration byte holds the following information:

Bit nr	description	
Bit 0 :	Measurement type	Read/write see Measurement type table
Bit 1 :	Measurement type	Read/write see Measurement type table
Bit 2 :	Measurement type	Read/write see Measurement type table
Bit 3 :	Measurement type	Read/write see Measurement type table
Bit 4 :	Measurement type	Read/write see Measurement type table
Bit 5 :	Measurement range	Read/write see Measurement range table
Bit 6 :	Measurement range	Read/write see Measurement range table
Bit 7 :	On board buffer	0 = cycle, at overflow remove oldest values 1 = full, at overflow stop buffer function

Measurement type table:

Type. setting	Description
00000	off
00001	Voltage
00010	Current
00011	Potmeter measurement
00100	PT100 temperature
00101	Full bridge
00110	Half bridge
00111	Quarter bridge 120 Ω
01000	Quarter bridge 350 Ω
01001	Quarter bridge 1K Ω
01010	TC type B
01011	TC type E
01100	TC type J
01101	TC type K
01110	TC type N
01111	TC type R
10000	TC type S
10001	TC type T
10010	Full bridge
10011	Resistor
10100	LVDT Full bridge
10101	LVDT Half bridge

Measurement range table:

Range setting	00	01	10
Voltage	-10V - +10V	-2V - +2V	-40mV - +40mV
Current	-	- 50 mA - + 50 mA	-
Potmeter		-0 – 100 %	-
PT100 temp.	-		
Full bridge	-		
Half bridge	-		
Quarter bridge	-		
TC type B	-	-	+250 - + 1820 °C
TC type E	-	-	-200 - + 1000 °C
TC type J	-	-	-200 - + 1200 °C
TC type K	-	-	-200 - + 1370 °C
TC type N	-	-	-200 - + 1300 °C
TC type R	-	-	- 50 - + 1760 °C
TC type S	-	-	- 50 - + 1760 °C
TC type T	-	-	- 50 - + 400 °C
Resistor		0-4000 ohm	
LVDT full bridge	+/- 0.5V/V	+/-0.1V/V	
LVDT half bridge	+/- 0.5V/V	+/-0.1V/V	

The second byte

The second configuration byte holds the following information:

Bit nr	description	
0	Measurement speed	Read/write see Measurement speed table
1	Measurement speed	Read/write see Measurement speed table
2	Measurement speed	Read/write see Measurement speed table
3	Measurement speed	Read/write see Measurement speed table
4	Thermocouple burn out detection	0 = off 1 = on
5	Auto send after measurement	0 = off 1 = on
6	Measurement method	Read/write see Measurement method table
7	Measurement method	Read/write see Measurement method table

Measurement speed table:

Speed setting	Speed
0000	off
0001	1 Hz
0010	5 Hz
0011	10 Hz
0100	25 Hz
0101	50 Hz
0110	100 Hz
0111	250 Hz
1000	500 Hz
1001	1000 Hz

Measurement method table:

method setting	method	
00	average value	
01	maximum value	
10	minimum value	
11	min & max value	not implemented yet

The third byte

The third configuration byte holds the following information:

Bit nr	description	
0	Excitation voltage	Read/write see Excitation table
1	Excitation voltage	Read/write see Excitation table
2	Excitation voltage	Read/write see Excitation table
3	Excitation voltage	Read/write see Excitation table
4	Excitation voltage	Read/write see Excitation table
5	Excitation voltage	Read/write see Excitation table
6	Auto send after measurement	0 = off 1 = on , also after power up
7	Sensor ID	0 = not used, 1 = used

Excitation voltage table:

Speed setting	Voltage
00000	off = 0V
00001	0.5V
00010	1 V
00011	1.5 V
00100	2 V
00101	2.5 V
00110	3 V
00111	3.5 V
01000	4 V
01001	4.5 V
01010	5V

The maximum value of the excitation voltage depends on the impedance of the bridge, and will be:

bridge impedance	max excitation voltage
< 120 Ω	2.5V
>120 Ω & >240 Ω	5V

The card will measure the excitation current. If this current is too high, the excitation will be switched off.

All the settings are stored in FLASH memory

The fourth byte

The fourth configuration byte holds the following information:

Bit nr	description	
0	scan speed	See Scan speed table
1	scan speed	See Scan speed table
2	multiplexer setting	See Multiplexer table
3	multiplexer setting	See Multiplexer table
4	multiplexer setting	See Multiplexer table
5	reserved	0
6	reserved	0
7	reserved	0

Scan speed table:

Scan speed	description
00	automatic (match measurement speed)
01	5 Hz
10	100 Hz
11	1000 Hz

Multiplexer table:

Multiplexer	description
000	12 x 2 wires
001	6 x 4 wires
010	4 x 6 wires
011	3 x 8 wires
100	10 x 2 + 1 x 4 wires (TC+CJC)

7.1.3 Data from the CA3460 through CAN bus

Measured values are sent by the CA3460 in the following data format:

Length: 8 bytes

Byte 0: bit 4...0 contain the multiplexer number (0 for CA3460)

bit 7, 6 & 5 identifies the value type:

000 = actual measurement value

001 = balance measurement

002 = tare measurement

003 = shunt measurement (bridge type only)

004 = minimal peak value

005 = maximum peak value

006 = not used yet

007 = sensor ID

Byte 1, 2, 3: measure index. This index is increased every 1 msec.

Byte 4, 5, 6, 7: channel value in floating point format (byte 4 = MSB)

The first channel sends its data with the card ID.

The second channel sends its data with the card ID+2, and so on

7.2 CA3410 Multiplexer card

The CA3410 multiplexer card uses the same command set as the CA3460. The channels are divided into 3 groups, each containing up to 12 multiplexer channels. Depending on the channel configuration, the channel uses 1, 2, 3 or 4 pairs or wires of the total amount available (3 x 12 pairs).

Example configuration of 2-wire channels:

1st channel: channel 0, multiplexer 0

2nd channel: channel 0, multiplexer 1

3rd channel: channel 0, multiplexer 2

...

12th channel: channel 0, multiplexer 11

13th channel: channel 1, multiplexer 0

...

Example configuration of 6-wire channels:

1st channel: channel 0, multiplexer 0

2nd channel: channel 0, multiplexer 3

3rd channel: channel 0, multiplexer 6

4th channel: channel 0, multiplexer 9

5th channel: channel 1, multiplexer 0

7.3 CD3733 Digital I/O card

The digital I/O card has 16 inputs and 14 outputs. For configuration purposes, the set of 16 inputs is addressed as a single channel (channel 0) with 16 bits representing the individual inputs. Likewise, the 14 outputs are addressed as channel 1.

The following commands can be given:

nr	description	
01	Set channel configuration	command content (3 bytes): 1 st byte: 01 (command) 2 nd byte: 00 (multiplexer channel nr) 3 rd – 6 th byte contain the channel settings response: no response
02	Get channel configuration When this command is sent to CAN ID 0, all the cards will send the configuration of each channel	command content (1 byte): 1 st byte: 02 (command) response: 1 message for each configured channel (7 bytes): 1 st byte: 02 (command) 2 nd byte: digital I/O type, standard = 0x50 3 rd byte: 00 (multiplexer channel nr) 4 th - 7 th byte: configuration of the channel
03	Get card serial number When this command is sent to CAN ID 0, all the cards will respond	command content (1 byte): 1 st byte: 03 (command) response (8 bytes): 1 st byte: 03 (command) 2 nd -5 th byte: card serial number 6 th byte: card slot number (0-14 = slot number in rack, 15 = card not placed in a rack) 7 th byte: 00 (card options) 8 th byte: 0x50 (card type)
04	Set device CAN ID	command content (7 bytes): 1 st byte: 04 (command) 2 nd -5 th byte: Card serial number to set CAN ID for 6 th -7 th byte: CAN ID to assign to the card response: no response
16	Set outputs	command content (7 bytes): 1 st byte: 16 (command) 2 nd -4 th byte: Values of the outputs to set (18 bits) 5 th -7 th byte: Mask of the outputs to set (18 bits, change only outputs whose bit is set in this mask)
19	Perform synchronization	command content (1 byte): 1 st byte: 19 (command) response: no response
20	Get firmware version	command content (1 byte): 1 st byte: 20 (command) response (5 bytes): 1 st byte: 20 (command) 2 nd -5 th byte: firmware version (integer value, i.e. 116 = v1.16)

7.3.1 Channel configuration bytes

First byte: 0 (reserved)

Second byte:

Measurement speed: If set, the values of the inputs or outputs are sent at the specified speed, regardless of state change.

Auto send: If set, the values of the inputs or outputs are sent as soon as a change occurs.

Bit nr	description	
0	Measurement speed	Read/write see Measurement speed table
1	Measurement speed	Read/write see Measurement speed table
2	Measurement speed	Read/write see Measurement speed table
3	Measurement speed	Read/write see Measurement speed table
4	reserved	0
5	Auto send after change	0 = off 1 = on
6	reserved	0
7	reserved	0

Measurement speed table:

Speed setting	Speed
0000	off
0001	1 Hz
0010	5 Hz
0011	10 Hz
0100	25 Hz
0101	50 Hz
0110	100 Hz
0111	250 Hz
1000	500 Hz
1001	1000 Hz

Third byte: 0 (reserved)

Fourth byte: 0 (reserved)

7.3.2 Data from the digital I/O card through CAN bus

Measured values are sent by the card in the following data format:

Length: 8 bytes

Byte 0: bit 4...0 contain the multiplexer number (always 0)

bit 7, 6 & 5 identifies the value type:

000 = values of all channels (bitfield)

001 = value of a single channel

Byte 1, 2, 3: measure index. This index is increased every 1 msec.

If all channels are sent:

Byte 4, 5, 6: channel values in bitfield (18 bits)

Byte 7: unused (always 0)

If a single channel is sent:

Byte 4: I/O index (0...17)

Byte 5: value (0 or 1)

Byte 6, 7: unused (always 0)

The input channels send their data with the card ID.

The output channels send their data with the card ID+2

8 Recommended CAN bus cable

The following cable is specially developed for CANBUS communication. It combines the communication and power conductors in 1 cable.

Make: Belden

Type: 3082A

ELECTRICAL CHARACTERISTICS:	

MAX. OPERATING VOLTAGE:	300 V UL PLTC, CMG
MAX. OPERATING VOLTAGE:	300 V C(UL) AWM
MAX. OPERATING VOLTAGE:	600 V UL AWM
MAX CURRENT/CONDR @ 25C (18 AWG):	5 A
MAX CURRENT/CONDR @ 25C (15 AWG):	8 A
NOM. CAPACITANCE BETWEEN CONDUCTORS OF DATA PAIR @ 1 MHZ:	12 PF/FT.
NOM. IMPEDANCE (DATA PAIR ONLY):	120 OHMS+/-12 OHMS
MAX. DELAY (DATA PAIR ONLY):	1.36 ns/FT
MIN. VELOCITY OF PROPAGATION (DATA PAIR ONLY):	75%
MAX. ATTENUATION (DATA PAIR ONLY):	
@ 125 KHZ:	.13 DB/100 FT
@ 500 KHZ:	.25 DB/100 FT
@ 1 MHZ:	.36 DB/100 FT
MAX. CONDUCTOR DC RESISTANCE @ 20 DEG C (18 AWG)	6.92 OHMS/1000 FT
MAX. CONDUCTOR DC RESISTANCE @ 20 DEG C (15 AWG)	3.60 OHMS/1000 FT
NOM. SHIELD DC RESISTANCE @ 20 DEG. C	1.8 OHMS/1000 FT.
NOM. LOOP INDUCTANCE (15 AWG)	.174 MICROHENRIES/FT
(18 AWG)	.258 MICROHENRIES/FT

Note: in less critical situations, a cheaper cable, like LIYCY 2x2x0.35, might be used. Always use different twisted pairs for communication and power lines. An overall screen, which must be connected to earth at only 1 side, is always recommended.

8.1 Bus speed versus measure interval

CAN bus speed	Maximum cable length	Measurement speed			
		1000 Hz	100 Hz	10 Hz	1 Hz
1000 kbit /s	30 m	7 channels	70 channels	192 channels	192 channels
800 kbit/s	50 m	5 channels	56 channels	192 channels	192 channels
500 kbit /s	100 m	3 channels	35 channels	192 channels	192 channels
250 kbit /s	250 m	2 channels	17 channels	175 channels	192 channels
125 kbit /s	500 m	-	8 channels	87 channels	192 channels
50 kbit /s	1000 m	-	3 channels	35 channels	192 channels
20 kbit /s	2500 m	-	1 channels	14 channels	140 channels

9 Specifications

9.1 CA3460 Specifications

For each of the 6 amplifiers and A/D converters on each card:

- Typical accuracy: 0.1% @ 1kHz
 - 0.02% @ 10Hz
- Bandwidth (-3dB): 200 Hz
- Sample rate: 1000 samples/second
- 24-bit A/D converter

Input signals:

- Voltage $\pm 40\text{mV}$, $\pm 2\text{V}$, $\pm 10\text{V}$
- Current $\pm 50\text{mA}$
input resistance 70Ω
- Potentiometer sensors
output in 0 – 100%
- Thermocouples
 - Type B $+250 - +1820\text{ }^{\circ}\text{C}$
 - Type E $-200 - +1200\text{ }^{\circ}\text{C}$
 - Type J $-200 - +1200\text{ }^{\circ}\text{C}$
 - Type K $-200 - +1370\text{ }^{\circ}\text{C}$
 - Type N $-200 - +1370\text{ }^{\circ}\text{C}$
 - Type R $-50 - +1760\text{ }^{\circ}\text{C}$
 - Type S $-50 - +1760\text{ }^{\circ}\text{C}$
 - Type T $-50 - +390\text{ }^{\circ}\text{C}$
- PT100 sensors: $-200^{\circ}\text{C} - +500\text{ }^{\circ}\text{C}$
- Resistor sensors: 0 – 4000 Ω

Bridge/Sensor supply:

- Fixed 2,5VDC
- Voltage accuracy: 1 %
- Min. permissible load: 60 Ω

Strain Gauge input (option 1):

- Full bridge
- Half bridge
- Quarter bridge 120 Ω , 350 Ω or 1000 Ω (4-wire)
- Meas. ranges $\pm 8\text{ mV/V}$, $\pm 400\text{ mV/V @ 5V}$
- Internal shunt resistor to check external bridge connections
- Sense technology (6-wire)
- Voltage: 0,5 - 5 VDC (in steps of 0.5V)
- Min. permissible load:
120 Ω @ 5V
60 Ω @ 2.5V

LVDT input (option 2)

- Full bridge
- Half bridge
- Excitation: 4Vrms – 5kHz
- Input ranges: 100 mV/V & 500 mV/V

Further details:

- 16 bit microcontroller
- CAN communication
max 1 Mbit/sec.
- Local SPI bus:
max 5 Mbit/sec.
- Operating temperature:
 $-25^{\circ}\text{C}.. +60\text{ }^{\circ}\text{C}$
- Dimensions:
Board: 191 x 145 mm
Front: 25 x 173 mm

Power supply:

- 9 – 36VDC 12VA

Sensor ID functions are not implemented yet

9.2 CM3410 Specifications

For the amplifiers and A/D converter on this card:

- Typical accuracy: 0.1%
- Bandwidth (-3dB): 200 Hz
- Max sample rate: 200 samples/second
- 24-bit A/D converter

Input signals:

- Voltage $\pm 40\text{mV}$, $\pm 2\text{V}$, $\pm 10\text{V}$
- Potentiometer sensors
output in 0 – 100%
- Thermocouples
 - Type B +250 - +1820 °C
 - Type E -200 - +1200 °C
 - Type J -200 - +1200 °C
 - Type K -200 - +1370 °C
 - Type N -200 - +1370 °C
 - Type R -50 - +1760 °C
 - Type S -50 - +1760 °C
 - Type T -50 - +390 °C
- PT100 sensors: -200°C - +500°C
- Resistor sensors: 0 – 4000 Ω

Strain Gauge input:

- Full bridge
- Half bridge
- Quarter bridge 120 Ω , 350 Ω or 1000 Ω (4-wire)
- Meas. ranges $\pm 8\text{ mV/V}$, $\pm 400\text{ mV/V}$ @5V
- Internal shunt resistor to check external bridge connections
- Sense technology (6-wire)
- Voltage: 0,5 - 4 VDC (in steps of 0.5V)
- Min. permissible load: 120 Ω @ 5V
60 Ω @ 2.5V

Further details:

- 16 bit microcontroller
- CAN communication
max 1 Mbit/sec.
- Local SPI bus:
max 5 Mbit/sec.
- Operating temperature:
-25° C.. +60 °C
- Dimensions:
Board: 191 x 145 mm
Front: 25 x 173 mm

Power supply:

- 9 – 36VDC 12VA

Sensor ID functions are not implemented yet

9.3 CD3733 Specifications

Digital input signals:

- 16 inputs:
- Opto-isolated
- Input current 4 mA
- Input voltage max 36 VDC
- Switching threshold > 6V

Solid state Output signals:

- 12 digital outputs:
- Output current max 1A
- Output voltage max 48VDC
- Resistance with active output is 25 ohm
- Normally Open contacts

Relay output signals

- 2 digital outputs:
- Normally Open/Normally Closed contacts using a relay
- Output current max 1A
- Output voltage max 48VDC

Further details:

- 16 bit microcontroller
- CAN communication max 1 Mbit/sec.
- Local SPI bus: max 5 Mbit/sec.
- Operating temperature: -25°C.. +60 °C
- Dimensions:
Board: 191 x 145 mm
Front: 25 x 173 mm

Power supply:

- 9 – 36VDC 12VA

9.4 PB3000 Specifications

Base: Embedded XP Computer
Data acquisition: stand-alone or as an Ethernet device connected to a PC
alternative: webserver-based
Data storage: on hard disk when used in stand-alone setup
Wireless options: GPRS, UMTS, WLAN; secured data-transmission
Operating temperature: 0-50 °C

9.5 Housings Specifications

Autolog 3000/1:

Number of card slots: 1
Dimensions: 215x245x48mm (WxDxH)
Power requirements: 9-36VDC/40 W direct input
Operation temperature: 0-50 °C

Autolog 3000/3:

Number of card slots: 3
Dimensions: 250x330x110mm (WxDxH)
Power requirements: 9-36VDC/40 W direct input
External power supply 100-240VAC/50-60Hz
(built-in power supply is optional)
Operation temperature: 0-50 °C

Autolog 3000/8:

Number of card slots: 8
Dimensions: 271x326x224mm (WxDxH)
Power requirements: 9-36VDC/100 W or
100-240VAC/50-60Hz
Operation temperature: 0-50 °C

Autolog 3000/16:

Number of card slots: 16
Dimensions: 500x326x224mm (WxDxH)
Power requirements: 9-36VDC/200 W or
100-240VAC/50-60Hz
Operation temperature: 0-50 °C